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How Perception of Decision Environment and Future Information Affects Changes in Delay Discounting Rates: Differences Across U.S. and China, Differences Before and After the U.S. 2018 Midterm Elections

Fran Walsh

How Perception of Decision Environment and Future Information Affects Changes in Delay Discounting Rates: Differences Across U.S. and China, Differences Before and After the U.S. 2018 Midterm Elections

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FRANCESCA NICOLE WALSH

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By
FRANCESCA NICOLE WALSH

Approved as to style and content by:

Youngbin Kwak, Chair

Andrew Cohen, Member

Brian Lickel, Member

Elena Vazey, Member

Paul Katz, Department Head
Neuroscience and Behavior

ABSTRACT

HOW PERCEPTION OF DECISION ENVIRONMENT AND FUTURE INFORMATION EFFECTS CHANGES IN DELAY DISCOUNTING RATES: DIFFERENCES ACROSS U.S. AND CHINA, DIFFERENCES BEFORE AND AFTER THE U.S. 2018 MIDTERM ELECTIONS

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FRANCESCA WALSH, B.S., UNIVERSITY OF MASSACHUSETTS AMHERST
M.S. UNIVERSITY OF MASSACHUSETTS AMHERST

Directed by: Youngbin Kwak, Ph. D

In this thesis, I will explore the idea that choices between present, smaller value options and future, larger value options depend on how much individuals trust the future to deliver the reward. Due to this aspect of trust, the individual must build their estimate of trust based on information for their present environment and their future expectations. This estimate of future trust can change across different time points in the same environment (i.e., before and after a national election) and between environments in the same time point (i.e., between two countries experiencing different economic rates of change). In this set of presented experiments, I will explore the link between decision environment and delay discounting, as well as the relationship between the contents of future perception and delay discounting. These two experiments will test differences in delay discounting (a) across two economic systems (China and the U.S.), as well as (b) before and after a national election (2018 U.S. Midterms). The results of the different economic environments study show that the delay discounting rates are significantly different across the two countries, specifically within the framing of present and future. These differences are not explained by differences in culture effects or individual differences in personality traits, suggesting that difference in environment is driving the effect. The results from the Midterm election experiments show evidence for differences in delay discounting between political identities and income groups. There are also differences in how these two groups perceive the future will be before and after the election. Overall, these experiments show that delay discounting can be affected by the way information is framed within an environment and how we expect our environments to change over time.

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CHAPTER 1

PREVIOUS LITERATURE AND EXPERIMENTAL OVERVIEW

1. 1 Delay Discounting Overview

Everyday decisions pass by us without feeling monumental or important at the time, such as the choice to eat lunch now or later. However, even this small choice requires knowledge of food availability, future commitments, and the necessity of the meal. Together information converges into the binary choice of "eat" or "not eat" and you move on with your day. Other choices are much more significant and take more cognitive effort, such as the decision between using $1000 to create a stock portfolio or using it to take a vacation.

More complex decisions like this one require deeper consideration into the immediate value of the vacation against the long term pay-off of investing in the stock market. Additionally, this trade-off decision will also require knowledge about the future prospects of the stock market and the overall trends of the economy, or the expected future value of the stock portfolio that can be weighed against the joy and subjective value of a vacation. You may also consider the joy you've felt on previous vacations against the anxiety you feel about potentially losing invested money. After considering these two choices, your prior experiences, and your future expectations a final decision will be made.

As humans, we have cognitive limits on our strategic decision-making and must use limited information to make inferences and decisions about the future. (Simon, 1954). Our inferences and predictions are formed from observations and

judgements of the world around us. But what happens when we think the future will be worse than the present? How does the exposure to uncertainty and negative future prospects effect our present decision making? Is it more rational to choose smaller, immediate rewards over larger rewards in the future if we think the future will be worse than the present? When making a choice between two options, how do your prior experience and future expectations affect the decision? How much impact does your environment, or changes in your environment have on these decisions? This master's thesis focuses on these questions while investigating the role of future expectations and different decision environments in decision-making. To do test for these differences, I will compare delay discounting rates calculated from a series of trade-off choices between small options in the present or larger options in the future. These tasks provide a good metric for testing trade-off choices that differ in temporal and valence domain.

Delay discounting refers to how rewards retain value through time. It is the concept that time itself has a value which can mitigate an object's financial value (for a review, see Teuscher & Mitchell, 2011). Similar temporal value calculations are also used in finance to assess present value and future value of assets in a firm or for investment value calculations. Delay discounting rates are modeled using an exponential or hyperbolic decay function (Kirby & Marakovic, 1996), where the delay discounting rate is the slope of the function. In these models, the delay discounting rate measures how quickly a reward decays in value over time;

such that, people with higher delay discounting rates are considered to be more impulsive because the present value of an object decays at a faster rate for these individuals.

Across the literature, many researchers have considered delay discounting rates as an individual trait in their tasks (for a metanalysis, see Odum, 2011). Delay discounting has been frequently used to study differences in impulsive populations compared to control populations such as people who suffer from drug addictions, ADHD patients, smokers, and obese individuals (Bickel et. al, 1999; Bickel & Marsch, 2001; Weller et. al, 2008; Barkley et. al, 2001). These studies specifically focus on the implications delay discounting rates can have on daily decision making.

While some studies examined how delay discounting can change within individuals primed with different mood states (Lampert et. al, 2016; Walsh, 2017; Calluso et. al, 2019), this current set of experiments will be one of the first to that show that delay discounting rates are not constant within individuals and that delay discounting rates can be affected by priming about the future, as well as changes in present environment.

1.2 Models of Delay Discounting

The first model of intertemporal choice comes from the work of economists in the 1930s. Traditionally, economists use an exponential model to predict inter-temporal decisions. These models traditionally use the formula: V=

Ae^{k*D}, where V= Future Value, A = Present Value, and D= Delay Length. In this model, the k-value represents the risk associated with waiting for the reward in the future, also known as the constant hazard rate (Samuelson, 1937).

However, in the 1990s the hyperbolic model became the primary model of intertemporal choice due to Green and Myerson's work. In this hyperbolic formula, the k value represents the rate that a reward decays in value over time, instead of a measurement of risk. Using the formula, V=A/(1+k*D), Green and Myerson have repeatedly demonstrated that estimating the k value using a hyperbolic formula best fits and predicts experimental intertemporal data (Green, Fry, & Myerson, 1994; Green & Myerson, 1996; Myerson & Green, 1995; Kirby & Marakovic, 1995). Another benefit of this model is that there can be an interpretation of the probability choice, when considering that V= A*P, and P = (1/ 1+k*D) (Green & Myerson, 1996, p. 497). In the experiments,

I will calculate the delay discounting rates using a hyperbolic model. I chose a hyperbolic model because it has repeatedly been shown to be internally consistent and accurately fit intertemporal choice data. Specifically, the estimates of k are constant across groups and within individuals using this model. Such that, if k values increase or decrease due to experimental manipulation, it can be trusted that the differences observed are due to experimental manipulations and not fluctuations in the model reliability.

1.3 Impact of Trust on Delay Discounting

The most famous experimental observation of delay discounting is the Marshmallow Experiment (Miscel et. al, 1972). In this experiment, children were given a marshmallow and told they could eat the one marshmallow now or wait for a second marshmallow when the researcher returned. This original experiment looked for the age where a child learns that if he delayed his want for something in the present, then he would receive a larger reward in the future. However, this experiment assumes that the child trusts the researcher to bring the second marshmallow. A follow-up study by Kidd et. al (2013) followed up on this question to see what happens then the researcher violates the trust of the child.

In this experiment, preschoolers ages 3-5 conducted the Marshmallow Experiment with one specific paradigm difference. Prior to the Marshmallow Experiment task, the child was given an art project to complete. For all participants, the experimenter told them that she would go get them a larger art set to use for the project. Next, half of the participants received the art set, while the other half of participants did not. When completing the marshmallow mask, children who received the art set were more likely to wait for the second marshmallow than children who did not receive the art set (Kidd et. al, 2013). This experiment provides evidence that our expectations of promises being fulfilled will influence delay discounting. Further providing evidence that people

incorporate their expectations about future behavior when choosing between options in the present and the future,

Another experiment specifically tested the role of social trust and delay discounting. In this experiment, the authors tested if the trustworthiness of the agent offering the reward in the future affected the participants' choice to pick the option in the present of the future. To do this, participants were given vignettes about three different agents which were written to seem untrustworthy, neutral, or trustworthy. After reading the vignettes, participants were given delay discounting choices with the agents' name inserted into the question to offer the future reward (i.e., would you prefer $10 today, or for *untrustworthy character* to give you $100 in three months). The experiment found that agents scored higher in trustworthiness increased the probability of the respondent waiting for a future monetary amount than agents scored lower in trustworthiness (Michaelson et. al, 2013). This experiment shows that we also take into account the likelihood of the other actor's expected behavior when we make decisions. Specifically, that we incorporate our trust and expectations in the choices of others when making intertemporal choices involves another person.

A similar experiment by Michaelson et. al (2016) tested if pre-school children absorb information about a person's trustworthiness when doing the marshmallow task. In this experiment, a child viewed an interaction between two adults worked on an art project together and then when one adult left the room, the other adult broke the project. When the first adult re-entered the room the

second adult either apologized for the accident (trustworthy condition) or lied about the accident (untrustworthy condition). After the child watched this interaction, the marshmallow task was completed with either the trustworthy or untrustworthy actor as the person promised to bring the second marshmallow. Children with the unworthy adult ate the marshmallow three times faster than children with the trustworthy adult. Only 18% of children in the untrustworthy condition waited for the second marshmallow comparted to 59% of children in the trustworthy condition. This experiment shows that delaying gratification depends on our perception of other's trustworthiness and our prediction of their behavior toward us. Additionally, this role of trust in trade-off decision making presents very early in cognitive development.

Overall, these experiments probed at the role of social trust and our expectations about a person's future behavior in our decision making. These experiments repeatedly show that people incorporate information about the actions of others into their decisions, and that this prediction of other's behavior begins very early in cognitive development. Specifically, that people are less likely to trust others if there is evidence of the other person violating trust. This witnessed violation of trust repeatedly leads to someone choosing the smaller present option over the larger future option. This research lends to my central inference that if we absorb information about the trustworthiness of actors in our decision environment, we are also absorbing information about the trustworthiness of social institutions built by these actors. Such that, if we don't

trust our social institutions or leaders, we are going to be less likely to rely on them to deliver larger rewards in the future, leading us to pick smaller options in the present.

1.4 How Resource Scarcity Affects Myopic Decision-Making

Resource scarcity is a term used frequently in both economics and biology. Overall, the term is used to mean the same thing: there is a limited supply of an object within a contained environment. In biology, resource scarcity is often used to measure animal foraging behavior for food or shelter. In economics, resource scarcity is used to explain many topics involving limited products or services in the market space. In general, the two disciplines use resource scarcity to observe how decision-making behavior changes across resource abundant or resource scarce environments.

In order to explain why those experiencing high levels of resource scarcity tend to make myopic choices involving limited resources, Shah, Mullainathan, and Shafir (2012) proposed that the environment caused by resource scarcity "will create a tendency to borrow, with insufficient attention to whether the benefits outweigh the costs" (Shah et. al, 2012, p. 683). To test this theory, the researchers ran a series of experiments that utilized popular turn-based game paradigms which could manipulate the participants' access to the number of turns. Their central claim is supported by the experimental finding that the resource scarcity group (low turn availability) showed increases attention during

Wheel of Fortune task, where participants have to guess missing letters to complete a well-known word or phrase, relative to the resource abundant group (high turn availability). Followed by the finding that resource scarce individuals with the ability to borrow extra turns during a similar game over-borrowed and perform much worse in the game compared to resource scarce individuals with a fixed set of turns. This effect of resource-scarce individuals over-borrowing and performing worse in a task was repeatedly observed across four other games (Shah et. al, 2012). Overall, this study shows clear behavioral evidence of how resource scarcity can lead to increased myopic and disadvantageous decision-making within individuals. For reviews on how poverty changes decision-making and risk preferences, see Shafir (2017) and Kish-Gephart (2017).

A new biological model has been proposed to address how resource scarcity effects the behavior and neurobiology of animals experiencing harsh environments. The Incentive Hope Hypothesis is a theory of animal motivation put forward by Anselme and Güntürkün (2018). The Incentive Hope Hypothesis describes how animals interact with limited resources in their environment and is different from previous theories on this topic such as Predictive Error theory put forward by Wolfram Schultz (for current opinion on topic, see Schultz ,2017). The Incentive Hope Hypothesis models the relationship between animals who experience harsh environments and their differences in foraging behavior relative to animals who experience abundant environments. Animals who experience high levels of uncertainty within harsh environments form expectations about

what the future will be, and are more likely to take immediate, smaller options compared to animals in less harsh environments. Animals in less harsh environments are more likely to explore more territory and turn down smaller options in the present for the opportunity to have a larger reward in the future. Both of these animals interact with their environments based on their previous experience and their future expectations of their reward likelihood and the relative risk of saying “no” to the present option. Specifically, this theory claims that harsh environments have the repeated effect that, “experiencing uncertainty or unpredictability results in the individual’s inability to predict whether the next foraging trial in a given environment will be rewards or not” (Anselme & Güntürkün, 2018, p. 5) which causes the animal to routinely take the present option over the risk of a larger option in the future. This model also connects neurobiological evidence for changes in the reward circuitry between animals of the same species who live in harsh environments relative to animals who live in abundant environments. Humans in harsh and uncertain environments have also been shown to exhibit similar behaviors to those described in the Incentive Hope Hypothesis (Walsh et. al, 2019). Specifically, it has been repeatedly observed that obesity levels follow track socio-economic status (SES) (Fredrick et. al, 2014; Crandell & Temple 2018; for a review see Monterio et. al, 2004) and appetite research has linked SES and perceived social status to appetite regulation (Cheon & Hong, 2017; Sim et. al, 2018).

In an experimental manipulation of subjective socioeconomic status, Cheon and Hong (2017) observed that calorie intake of participants significantly changed across the relative low SES group and the relative high SES group. In this experiment, participants were randomly assigned to a higher subjective SES group (where they were told to envision them interacting with someone in the lowest income bracket relative to themselves) or a lower subjective SES group (where they were told to envision them interacting with someone in the highest income bracket relative to themselves), followed by filling out a questionnaire of what they would like to eat at a lunch buffet. In later experiments, this questionnaire was replaced with actual food the participant could choose to eat. For each participant, these food items were added together to get a measure of the total the kcal of energy the participant chose to consume. Across four studies, it was repeatedly found that lower subjective SES groups chose higher calorie items and had a larger overall appetite than the higher subjective SES groups (Cheon & Hong, 2017). This experiment shows that even subjective experience of resource scarcity relative to more resource abundant individuals results in higher calorie intake and appetite.

Using a similar subjective status paradigm as the previous experiment, Sim et. al (2017) tested for increased ghrelin release, an orexigenic hormone specifically involved in controlling hunger, in lower subjective status participants. This follow-up experiment wanted to determine if ghrelin release is influenced by changes in social status, and if this increased release of ghrelin in low subjective

SES participants caused the previous finding of low subjective SES participants having increased appetite and calorie intake. To do this, the researchers took a baseline blood sample and appetite rating from the participants. Then the participant either completed a control task or a fake aptitude task designed to manipulate the participant into feeling that they were low-achieving relative to their peers. After the both groups completed their tasks, participants were presented with a milkshake. The participants' blood was sampled before consuming the milkshake. Thirty minutes after consuming the milkshake, the blood and appetite ratings were re-sampled. Analysis showed that ghrelin concentration significantly spiked in low subjective status participants after completing the task and the levels stayed significant thirty minutes after the milkshake was consumed. The control group did not significantly change in ghrelin concentration from baseline to before milkshake but did decrease after the milkshake. This experiment is one of the first to show biological evidence of hunger hormones being influenced by external subjective social status, and that subjective social status significantly impacts appetite regulatory systems within the human body.

While it has been repeatedly observed that resource scarcity and perceived social status influences decision-making in disadvantageous ways, there is also research on interventions that build generalized trust in impoverished communities can reduce overall rates of myopic decision-making (Jachimowicz et. al, 2017). The first finding of Jachimowicz et. al (2017) paper

showed that income is a significant predictor of level of generalized trust, such that higher income individuals have more generalized trust than lower income individuals. The second finding of this paper showed that personal financial need, not income level, predicted an intertemporal trade off of $100 or $150 in one year. As a solution to reducing this type of myopic decision-making, a two-year field intervention focused on building community trust was initiated in four rural Bangash districts. This intervention successfully increased general trust and lead to a reduction in myopic decision-making by increasing the amount of options chosen in the future over the present within these communities.

Overall, these experiments show repeated evidence that relative socio-economic status and level of resource scarcity will influence intertemporal trade-off decisions. Such that individuals with higher resource scarcity are less likely to wait for a larger reward in the future, over a smaller option in the present. This behavior persists even when the long-term choice has a higher pay off than the present choice. This trade-off behavior is repeatedly seen in food choices within both the animal and human literature. Finally, interventions that build a sense of general trust can reduce this preference for short-term options over long-term options. Collectively, this research shows that the resource availability of the environment and the level of future trust about future access to resources significantly impact inter-temporal choice behavior.

1.5 The How Framing Change Delay Discounting Rates

Since previous studies have shown that people incorporate the behavior of others and our economic environment when making intertemporal trade-offs. Different interactions with actors and the decision environment led to information being presented in different orders. So, the next question becomes how do these specific differences in information and order of presentation effect decision-making? To test this question, tasks must utilize the "framing effect" to shift the participant's decision environment perspective. The framing effect is the observation that changing the layout and presentation of information changes the decision made after processing the information. For example, asking if someone would "prefer $50 today or $75 in three months" results in a different answer than asking if someone would "prefer $75 in three months or $50 today". The framing effect is part of the larger discovery of Prospect Theory and the asymmetry between gains and losses, or the difference in how people weigh gains and losses (Tversky & Kahneman, 1981).

In this thesis, I will focus on two types of framing: valence and temporal. Temporal framing will be used to shift the participant's time perspective to focus on either the present or future. Valence framing will be used to shift the participant's reward valence perspective to focus on either gains or losses. Valence framing has previously been studied as continuation of the work on asymmetry between gains and losses studies "the sign effect", or the effect of reward valence (gain or loss) on delay discounting questions. The sign effect is the repeated finding that delay discounting rates are higher for gain domains and

lower for loss domains – showing that people prefer to get rewards in the present instead of the future and prefer to push losses to the future (Lowenstein &Thaler, 1989; Thaler, 1981).

While temporal framing is a newer topic that focuses on how delay discounting rates change when a participant focuses on different temporal horizons. Changing the temporal order of options between receiving something now or in the future, compared to in the future or now also changes choice behavior. Participants will have lower delay discounting rates for options when anchored to the present and offered an amount in the future compared to the higher delay discounting rates seen when participants are anchored in the future and are offered something now (Appelt et. al, 2011, Weber et. al, 2007)

There are real world changes in decision-behavior due to the framing effect. A high-impact example of the real-world effect of framing is the difference in organ donation levels across countries. The framing effect is found in the opt-in vs. opt-out questions frequently used when enrolling organ donors at the DMV. It is repeatedly observed that countries with the highest rates of organ donation are the countries with questions that ask if the person would rather opt-out of organ donation (donation enrollment rates above 75%) compared to the countries that ask if the person would rather opt into organ donation (donation rates below 30%) (Willis & Quigley, 2014; Davidai et. al, 2012).

Recently, there has been some neurobiological evidence to show that framing changes neurobiological responses to probabilistic reward tasks

(Mooshagian et. al, 2014). In this experiment, researchers used transcranial magnetic (TMS) in human subjects to target the primary motor cortex (M1) during a probabilistic reward task with three levels of probability and two levels of uncertainty. There was no effect of uncertainty on motor evoked potentials (a measure of corticospinal neuron excitability) but motor evoked potential amplitudes increased during the “find” task frame and decreased during the “avoid” task frame. These results show that M1 is sensitive to framing of reward tasks and the activity differences reflect responses to reward probability rather than outcome uncertainty.

1.6 Experimental Overview

As shown in this literature review, there is converging evidence that decisions between accepting rewards now or waiting for a better reward in the future can be influenced by our future expectations. There is neurobiological evidence of environment shaping reward circuitry provided in the Incentive Hope Hypothesis. As well as significant behavioral evidence from the delay discounting and marshmallow task literature showing that people incorporate the expectations of another person’s behavior into their intertemporal choice. This converging evidence intertemporal choice being influenced by future expectations and perception of future environment provides a gap in the literature that can be filled with a model of how environment, the human brain, and intertemporal choices may be interacting.

In the following chapters, I will first test if there are differences in delay discounting across two separate decision environments (the United States and China). This experiment will utilize temporal and valence framing to test the difference it causes across two very different economic systems. Then I will test if delay discounting rates are different before and after the 2018 Midterm Elections, a major American socio-political event. These two experiments will investigate how the role of decision environments and large-scale changes in decision environment affect trade-off choices between small present options and larger future options. This experiment will investigate if there are overall differences before and after the election, as well as if different political parties and income groups have differing responses to the election results. The goal of this thesis is to study how the environment shapes and changes delay discounting decisions in order to understand how people incorporate future expectations of their decision-making. This behavioral research will lay the groundwork for future neurobiological studies that will probe the underlying neural circuitry of these decision phenomenon.

CHAPTER 2

THE EFFECT OF DIFFERENT SOCIOECONOMIC ENVIORNMENTS ON DELAY DISCOUNTING

2.1 Literature Review

Many of our decisions must come from our current access to resources and how we expect the world to be down the road. For example – investing in your 20s is widely considered to be a sound financial decision because it gives you the longest time period to make up for market losses and profit from overall increases in market value and interest rates. However, if the young person doesn't trust that he or she will receive an equal or greater reward over a period time, then there is a disincentive to invest. This questioning of investment profitability certainty comes from a person's observations and research into the current markets, historic market trends, and the stability of the present economic institutions. If any of these institutions seem less likely to fulfill the promise of higher net value on an investment, the person will seek other financial alternatives.

Another major component of economic environment is the relative distribution of wealth and economic inequalities within the country. Wealth inequality is calculated by comparing the wealth distribution of a country against a normal distribution. The difference between these two curves gives you a measure of the direction and amount of wealth inequality within a country. In 2014, economist Thomas Piketty found global wealth and income inequality

rates, specifically within the United States and Europe, are at levels last seen in 1920s (Piketty, 2014). In February 2019, the National Bureau of Economic Research published updated measurements of U.S. wealth inequality with levels that show the rates are actually higher than originally estimated in 2014 (Zucman, 2019). The soaring wealth inequality of the 1920s has been considered to be a contributing factor to the Great Depression (1929-1939). Economic inequality has also been associated with social maladies and public health concerns. A comprehensive epidemiology book, *The Spirit Level: Why greater equality makes societies stronger*, pursued this line of research and showed a repeated pattern of social maladies increasing as a function of income inequality. This research showed countries with the highest rates of crime, disease, and a number of social maladies (such as mental health and risky teen behavior) also had the highest rates of income inequality (Wilkinson & Pickett, 2014).

Wealth and income inequality have been shown to specifically influence monetary decision making. In an experimental manipulation, participants' awareness of higher levels of economic inequality resulted in more risky gambling and monetary decisions. For example, participants who were manipulated to think they were in the lowest income bracket in a highly unequal society were more willing to take on risky gambles in order to close the gap between themselves and the top income bracket. This amount of risk increased depending on the width of the participants' perceived gap between themselves and the top income bracket. Showing that more perceived equality resulted in

less risk-taking behavior and more inequality results in more risk-taking behavior (Payne et. al, 2017).

Responding to specific information (inflation rates) in the economic environment has been observed in an experimental setting. A delay discounting experiment exploring the role of interest rates in delay discounting choices found that participants were sensitive to increasing, neutral, and decreasing interest and inflation rates. Participants played a three investment games with thirty-six trials in each game. Each game had a different inflation rates, nominal interest rates, or combinations of the two to test real interest rates (real interest = nominal interest rate – expected inflation rate). Researchers tested if delay discounting within a participant changed across the different interest rate conditions. Changes in the inflation rates caused higher delay discounting rates for inflationary trials, and lower delay discounting rates for deflationary trials. Nominal interest rates followed the same pattern, as well as combinations of interest rates and nominal rates (Kawashima, 2006).

Based on these psychology studies and reports on economic metrics of different countries, I propose that: there will be differences in economic decision-making between two different countries because the economic information and prospects are different across the two environments. This difference in environment and information will result in measurable differences in decision-making. These measurable differences should appear when you test for preference in trade-off choices between smaller rewards in the present or larger

rewards in the future. Environmental information should also affect how a person interprets the framing of these trade-off decisions.

China and the U.S. are very different economic systems, which makes them good options to use in order to determine if differences in decision environments result in differences delay discounting. In a global survey of 35 countries, delay discounting rates were found to be higher in China than in the United States (Wang et. al, 2016). One possible factor leading to China's higher delay discounting rates is the unprecedented rate of economic and social change which has occurred in China over the last 30 years. This rate of change is incredibly rapid compared to the U.S.'s relatively stable economic and social growth rates over the same time period.

If Chinese participants are incorporating this rapid sense of change into their daily decision making, they may prefer taking smaller options today over larger options in the future because the future holds more uncertainty and risk. If this incorporation of rate of change is occurring, it is expected that Chinese participants will have higher delay discounting rates (choose more smaller, present options) in both gain and loss domains in a choice titration experiment because they trust the present option more than the risk of taking the future option, even if the future option may be worth more in value. Specifically, I expect that these differences will be visible in both the present vs. future framing comparison and the gain vs. loss framing comparison, such that the Chinese participants will have a lower delay discounting rate for the future gain condition

(choosing to pick future options over present options) than the present gain condition and Americans will have a more equal delay discounting rate for the present gain and future gain conditions due to their incorporation of a relatively stable rate of social and economic change.

To test how differing economic environment affects decision making, I will test the difference in the delay discounting rates between the United States and China using four choice titrations adapted from Applet et, al (2011). I will also test for the difference of the framing effect on delay discounting, which includes testing framing in the temporal and valence domains. Choice titration is this experiment's method of determining a participant's delay discounting rate.

Choice titrations are a method of determining where smaller amounts in the present are equal to larger amounts of money in the future. This is done by holding one amount constant and varying the second amount by a fixed amount in each trail. In this context, a trial is one question within a set of eleven questions (For details and methods of analysis, see Section 2.3.2.1). This experiment utilizes four choice titration conditions which test: gains framed in the present, gains framed in the future, losses framed in the present, and losses framed in the future. The titration trials are presented below. The italicized and underlined amount increased by $5 increments in each trial. All four conditions measure a difference between the present and future option of - $10 net loss to + $40 net gain. All trials are presented in the same order of lowest difference to highest difference in a fixed order. Please see Appendix A for the full paradigm.

Table 2.1: Example Choice Titrations conditions presented to participants.

Present Gain	Would you prefer $50 gift card today, or *$70 gift card* three months from now?
Future Gain	Would you prefer $70 gift card three months from now or a *$50 gift card* today?
Present Loss	Would you prefer a $50 fine today or *$70 fine* three months from now?
Future Loss	Future Loss: Would you prefer $70 fine three months from now or a *$50 fine* today?

Previous studies have shown that individuals discount the gains more than they discount losses in both the present and future (Thaler et. al, 1981; Appelt et. al, 2011). In this study, we want to examine if the amount of discounting gains and losses in the present and future changes across economic system. Economic systems refer to the overall structure, function, and efficiency of markets and industries within a contained limit. For the purpose of this discussion, economic systems will be confined to the economic institutions and market fluctuations of a specific country.

In this experiment, I seek to understand how being in different countries, with different economic and political systems, affect choices across the temporal and valence domain. This experiment is a follows a line of previous financial research which shows delay discounting rates change across country (Wang et. al, 2016). In this experiment, I am testing if these country differences are affected by framing. Framing has previously been shown to influence delay discounting rates (Applet et. al 2011; Weber et, al, 2007; Lowenstein 1988). To do this, I will use four choice titrations set in different temporal (present framing vs. future

framing) and valence (gain framing vs. loss framing) domains to calculate group delay discounting rates, and test for differences by country. Additionally, I will also compare the degree of sign effect across the two cohorts. I will also test if these country differences remain when controlling for differences in individual traits and cultural differences. I will use personality and culture scales to account and control for any differences that may be introduced by culture and individual differences to isolate the effect of different decision-making environments.

2.2 Hypothesis and Predictions

I hypothesize that a person's country, representing differences in economic and social environments, will influence delay discounting rates because participants include environmental information in their expectations of the future. I predict that there will be significant differences in the mean delay discounting rates between the China and United States samples. This difference will be significant in all four of the domains (present frame, future frame, gain frame, loss frame). In the gain domain, I predict that the difference in delay discounting rates between the present and future frame for Chinese will be will be larger than the Americans, where the difference in delay discounting rates between the present and future frame will be smaller. This difference in delay discounting will show that Chinese participants will be more sensitive to temporal framing than American participants. In the loss domain, I predict that the both countries will prefer to push losses to the future, resulting in low delay discounting rates, and that this rate will be lower for future framed fines relative to

present framed fines, showing that participants are more willing to push fines to the future when the reference point is paying today. For all conditions, I predict China will have a higher delay discounting rates than the U.S. since this trend has been previously observed. Additionally, I am interested testing if these Country, Valence and Time effects remain when controlling for cultural differences and time perspective and impulsivity personality traits (ie, impulsivity, gambling tendencies). However, I predict that all three effects will remain significant after controlling for these factors because the difference in delay discounting is dependent on the different decision environments and not participant trait differences.

2.3 Methods

2.3.1 Participants

Overall, the total experimental sample is 606 participants (M = 19.12 yrs., SD= 1.35) (See Table 2.1). Participants who did not complete the survey were not included in data analysis. Participants were also excluded if their response in choice titrations showed non-logical shifts across time. For example, if a participant chose $50 today over $70 in three months, followed by $75 in three months over $50 today, and then went back to choosing $50 today over $80 in three months. This would show the participant did not reach a point where the option in the future was equal to the option in the present.

Data was collected in the United States and the People's Republic of China, The United States participants (n= 290, M = 20.00 yrs., SD = 1.25) were

University of Massachusetts Amherst students enrolled in an undergraduate psychology course at the university. The choice titration was administered in the U.S. as an online study via the UMass Amherst online experimental study recruitment board (SONA). Students who enrolled via SONA were given one extra credit in a psychology course for 30 minutes of their time. Participants who did not complete the survey were not included in data analysis. The Chinese participants (n = 316, M = 18.25 yrs., SD = 0.76) were first year Chinese National Science Academy psychology students. The choice titration was administered as part of their beginning of the semester survey packet. In both the US and Chinese sample, participants were given one of the four versions of the Choice Titration questionnaires for a between-subjects design (see section 2.3.2). Table 2.1 shows participant information for each group and Choice Titration condition.

Table 2.2: Participants in Chinese and United States Samples

Choice Titration Group	China n	U.S. n	China Mean Age	U.S Mean Age
Present Gain	116	67	18.2	19.9
Future Gain	63	61	18.36	20.01
Present Loss	71	83	18.07	20.01
Future Loss	66	79	18.36	19.9
Total	316	290	18.25	20.00

2.3.2 Survey Design

The survey included one of the four versions of Choice Titration questionnaires developed by Applet et al. 2011. Additionally, to determine the contribution of socio-cultural orientation and personality traits in delay discounting difference across the US and Chinese samples, we additionally included several

individual difference measures as described in detail below. After completing the survey measures, the participant was randomly assigned to one of the four choice titration conditions. This experiment used a between subject design, where each participant took one version of the choice titration, but all subjects responded to the same personality scales. All participants received choice titration items in the same order.

2.3.2.1 Choice Titrations

Choice titrations measure the decision point where the participant switches between picking options in the future to options in the present. This choice is the decision inflection point that represents the place in the temporal horizon where the option presented in the future is equal to the option in the present, and the participant can no longer justify picking the future option over the present option. I am using this measurement of delay discounting because it captures the specific point on the temporal horizon where two rewards are equal to one another. In this experiment, there are four choice titrations with 11 trials. Each trial moves in $5 increments from a -$10 net loss to a $40 net gain. All choices are given across a fixed time increment of three months. The gain domain titrations were framed as gift cards and loss domain titrations were framed as fines. Each condition had the gain or loss either accelerating toward (present) or away (future) from the participant (Adapted from Applet et. al, 2011).

2.3.2.2 Measures of Socio-Cultural Orientation and Personality

In this experiment, while I generally hypothesize that the delay discounting rates will be different between the United States and China because the decision-environments of the counties are different, there are specific trait aspects that need to be taken into consideration during analysis. Tested for country overall could lead to confounds such as group differences in cultural beliefs of group differences in personality traits. To control for these cohort differences, scales that gather information in socio-cultural orientation and personality were included in the task. This information was collected through a series of trait questionnaires.

To test cultural differences, the participants completed the Singelis Self Construal Scale (Singelis, 1994) which measures a participant's Independence and Interdependence and the Asian Values Scale (Kim et. al, 2005) which measures how much the participant subscribes to Asian cultural values and social beliefs. These two scales give valuable information on differences in cultural beliefs across the two cohorts which could contribute to the effect of country in any statistical tests.

To test for differences in trait impulsivity, the participants complete the Barratt Impulsivity Scale (Patton et. al, 1995) which measures a participant's trait impulsiveness and Gambling Related Cognition Scale (Raylu & Oei, 2004) which measures a participant's gambling and risk-taking tendencies. Together, these scales gather information about the participant's opinion risk taking behavior and their trait impulsivity.

Finally, to test for differences in time perspective, participants compete the Zimbardo Time Perspective Inventory (Keough et. al,1999) which measures how much the participant thinks about the future and Future Orientation Scale (Steinberg et. al, 2009) which measures how much the participants envisions themselves in the future. Including these scales provides information about the participant's consideration of time in their decision-making and how often they envision their future.

Together, these scales provide information about the participants' cultural beliefs, risk-taking behavior, and time perspective. This information can be used to control for any differences between the cohorts that are derived from differences in cultural background or personality traits. All scales will be entered into a principle components analysis to be used as co-variates in later statistical tests.

2.4 Analysis

The delay discounting rates were calculated using the standard hyperbolic formula (V= future option value, A= present option value, k= discount rate, Delay Length= time in years that the second option is delayed). The delay discounting rate was calculated using values from the first trial when a participant chose the future option over the present option using EQ_1. To keep comparisons standard across the different choice titration conditions, the difference between the constant amount and the variable amount was used to calculate the delay discounting rate. A sample calculation is shown below:

$$EQ_1: \quad |V| = \frac{|A|}{(1+k*Delay\ Length)} \quad 70 = \frac{50}{1+\left(\frac{3}{12}\right)k} \quad 70(1+0.25k) = 50;\ k = -1.143$$

Delay discounting rate (k) was calculated using the above formula in the four Choice Titration versions. As this is a between-subjects design, there is only one delay discounting rate for each participant. Additionally, the four conditions were broken down into two between-subject fixed factors that could test for Temporal and Valence framing. To do this, a Time factor was created to code for Present Frame and Future Frame. This collapsed the Present Gain and Present Loss into one group, and Future Gain and Future Loss into a second group. Similarly, a Valence factor was created to code for Gain Frame and Loss Frame. This collapsed the Present Loss and Future Loss into one group, and Present Gain and Future Gain into a second group. These two between-subject factors were used into later statistical tests to test for differences in framing.

The discount rate was first compared across the present vs. future (Time) and gain vs. loss (Valence) frames between the US and Chinese samples (Country), using a 2 Country (US vs. China) x 2 Time (present vs. future) x 2 Valence (gain vs. loss) ANOVA using Country, Time and Valence as fixed factors. This was followed up by two 2 (Country: U.S., China) by 2 (Time: Present, Future) ANOVAs conducted separately in the Gain domain and the Loss domain. An identical procedure was followed to test for differences in the Present and Future domain using a 2 (Country: U.S., China) by 2 (Valence: Gain, Loss) ANOVAs.

The contribution of socio-cultural orientation and personality traits was examined first by performing a principle component analysis on all of the survey measures excluding the Choice Titration questionnaire (i.e., AVS, ZTPI Future, BIS-11, FOS, GRCS, Interdependence, Independence) to isolate component associated with socio-cultural orientation or personality traits relevant to impulsive decision making. The two identified components were included as covariates in the ANOVA. Additionally, as the US and Chinese sample were different in age (t= -20.35, p= 0.000, df= 471.528), we included age as a covariate in all our analyses.

2.5 Results

2.5.1 Delay Discounting Differences Across U.S. and China

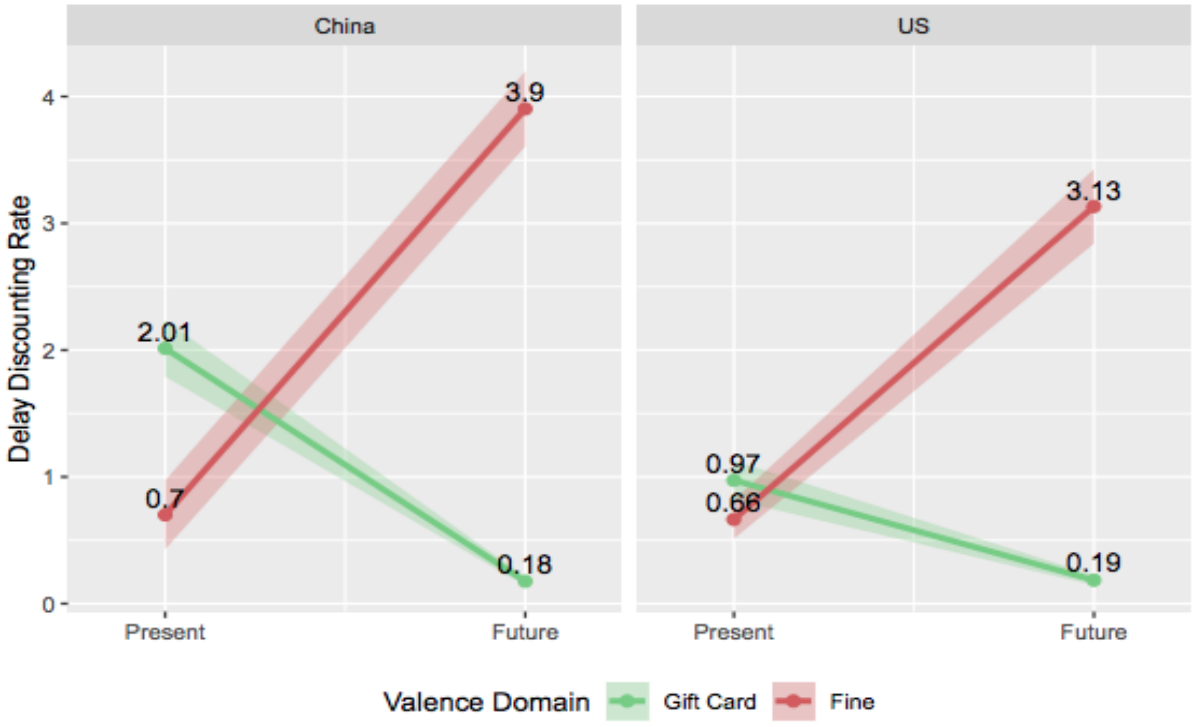

Figure 2.1: This figure shows the differences in the delay discounting means between China (left) and the U.S. (right). Both countries show an asymmetry of discounting in both aspects of the Valence domain (gift card and fine). Error bars represent SEM for each condition and group.

First, I investigated the difference in delay discounting across Country, Time, and Valence. To do this, a 2 x 2 x 2 ANOVA (Country: China, U.S.; Frame: Present, Future; Valence: Gain, Loss) on discounting rate (k value) was conducted, This analysis revealed a significant main effect of Valence ($F(1,598)=104.466$, $p= 0.000$), Time $F(1,598)=268.017$, $p= 0.000$), and Country $F(1,598)=27.187$, $p= 0.000$), an interaction between Valence and Time $F(1,598)=744.385$, $p= 0.000$), and a three-way interaction between Valence, Time, and Country $F(1,598)=35.777$, $p= 0.000$) (Figure 2.1 a-b).

This three-way interaction shows that the delay discount rate was higher in China, for the present gain and the future fine frames. However, the U.S. and China did not have differences in delay discounting for the present fine and future gain frames. The Valence by Time interaction showed that the discount rate was higher in gift card conditions compared to fine conditions for options framed in the present, but the delay discounting rate for the fine condition was greater than the gift card condition for options framed in the future.

2.5.2 Comparison of Temporal Framing Effect Across Country

Next the three-way interaction was followed up to investigate the role of Country in the temporal and valence frame separately. First, I investigated the role of Country in the Temporal domain. To investigate the degree of temporal

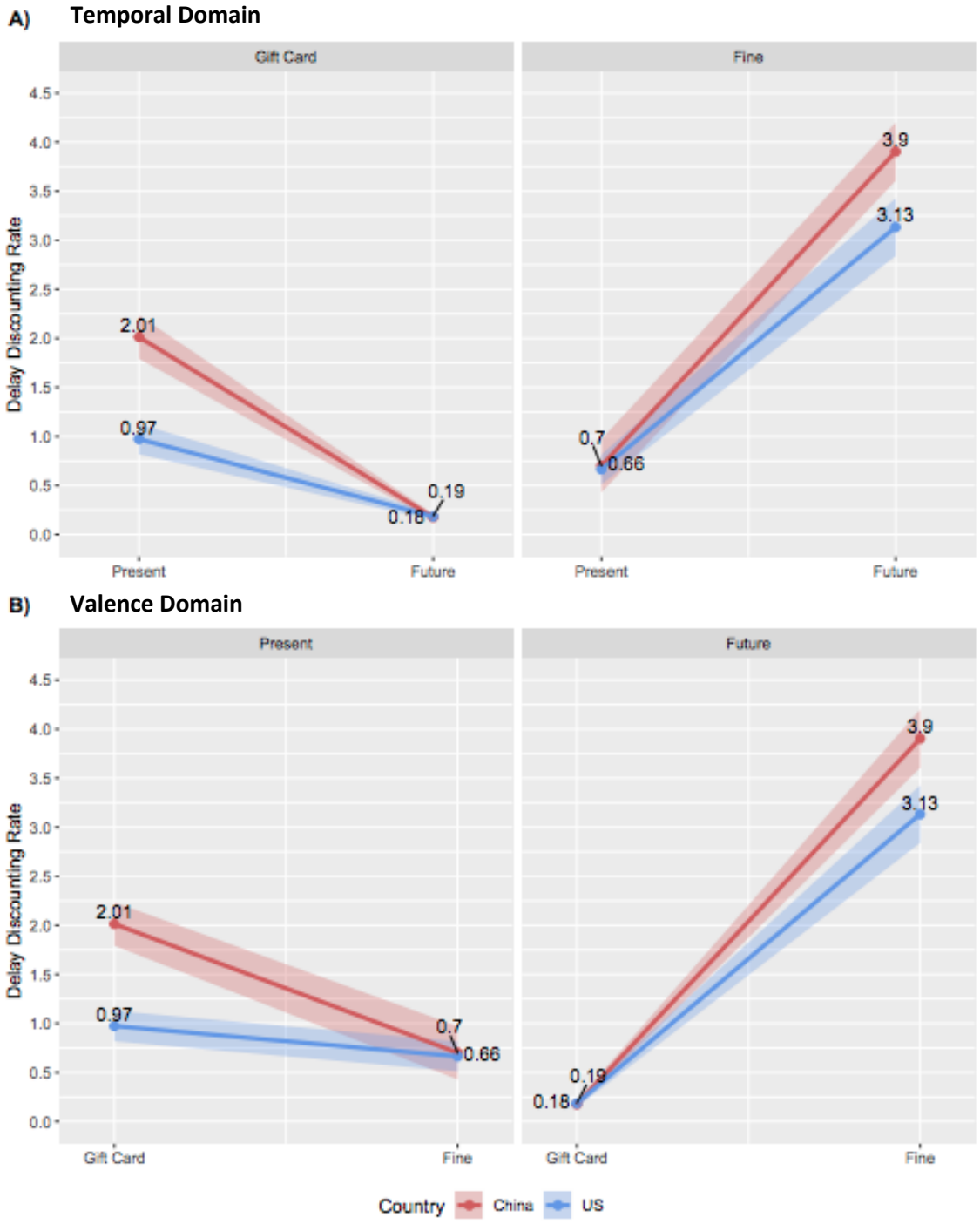

Figure 2.2: This figure shows the countries' mean delay discounting rates differ across the Temporal (A) and Valence (B) domain. Error bars represent SEM for each condition and group.

framing, a 2 x 2 ANOVA (Country: China, U.S.; Time: Present, Future) was conducted for the Gain condition and the Loss condition separately (Please see Figure 2.2a).

In the Gain domain, there was a significant main effect of Country ($F(1,335) = 28.332$, $p = 0.000$)) and Time ($F(1,335) = 239.098$, $p = 0.000$)). Additionally, the interaction between Country and Time ($F(1,335) = 35.340$, $p = 0.000$)) was significant. In the Loss domain, there is a significant main effect of Country ($F(1, 264) = 6.482$, $p = 0.011$) and Time ($F(1, 264) = 451.607$, $p = 0.000$). Additionally, the interaction between Country and Time ($F(1, 264) = 9.055$, $p = 0.003$) was significant. All main effects and interactions are significant in both domains, suggesting that the differences between time frames and within each country occur in both the gain and loss conditions. In both the gain and loss conditions, China has a significantly higher delay discounting rate for present gains and future losses.

2.5.3 Comparison of Valence Framing Effect Across Country

Next, to follow up the three-way Country, Time, and Valence interaction, I tested for differences in Valence and Country on delay discounting rates, two 2 x 2 ANOVAs (Country: China, U.S.; Valence: Gain, Loss) were run separately for the Present and Future conditions (Please see Figure 2.2b).

In the Present domain, there is a significant main effect of Country ($F(1, 335) = 28.332$, $p = 0.000$) and Valence ($F(1, 335) = 239.098$, $p = 0.000$). Additionally, the interaction between Country and Valence ($F(1, 335) = 35.340$,

p=0.000) is significant. In the Future domain, there is a significant main effect of Country (F (1, 264) = 6.482, p= 0.011) and Valence (F (1, 264) = 451.607, p= 0.000), as well as a significant interaction between Country and Valence (F (1,264) =9.055, p= 0.003). All main effects and interactions are significant in both domains, suggesting that the differences between valence frames and within each country occur in both the present and future conditions. In both the present and future conditions, China has a significantly higher delay discounting rate for present gains and future losses.

2.5.4 Specifying the Differences in Country Across the Four Choice Titrations

We also compared the delay discounting rates of the two countries in each titration condition separately using two-sample t-tests. These independent t-tests revealed significant differences were found in the present gain (df = 180, t= 7.692, p= 0.000) and future loss (df =143, t= 3.664, p= 0.00) conditions, but not in the future gain (df= 152, t= -0.343, p= 0.732) and present loss (df =97, t= 0.234, p= 0.815) conditions.

2.5.5 Using Factor Analysis to Create a Culture and Personality Measurement

To determine the contribution of personality traits and socio-cultural orientations in delay discounting differences across U.S. and China, we first performed a Principle Component Analysis to collapse across the survey measures including the Asian Value Scale, ZTPI Future Subscale, BIS-11,

Future Orientation Scale, Gambling Related Cognition Scale, Interdependence, and Independence. First, we examined if factor analysis was suitable for the nine scales. The Kaiser-Meyer-Olkin measure of sampling adequacy was 6.26, which is far above the recommended value of 0.6, and the Bartlett's test of sphericity was significant χ^2 (21) = 721.752, $p < 0.000$. Finally, the communalities for all items were above 0.3 (See Table 2.2). The result of the factor analysis indicated that a 2-factor solution was supported for our sample. The first and second component explained 29.77% and 24.033 % of the variance, respectively. This analysis explained 53.803% of the variance and had eigen values above 1.5, with other factors dipping under 0.8 (see Figure 2.3 for Scree Plot). All items pertaining to cultural differences loaded onto the first factor, and all items related to time personality loaded onto the second factor (see Table 2.3 for factor loadings). All factor loadings were above .3 with no cross-loading onto another factor. An independent t-test shows that China and the United States differ in means for Component 1 (Culture, t = 26.555, df = 597, p = 0.000) but not for Component 2 (Personality, t = 1.730, df = 597, p = 0.084). This shows that the Culture Component is significantly different across the two countries, but the Personality Component is not. The two component scores were included as covariates in the previously tested 2 x 2 x 2 ANOVA (Country: China, U.S.; Frame: Present, Future; Valence: Gain, Loss) in delay discounting to determine their contributions.

Table 2.3: Factor loadings and communalities based on a maximum likelihood analysis with varimax rotation for 6 personality scale scores

Factors	Component 1: Culture	Component 2: Time Personality
Asian Value Scale	0.869	
ZTPI Future Sub-score	0.811	
BIS- II		0.822
Future Orientation Scale		-0.738
Gambling Related Cogitation Scale		0.540
Interdependence	0.743	
Independence		-0.346
Eigen Value	2.056	1.682
Variance Accounted	29.77 %	24.033 %

Note. Factor loadings < 0.3 are suppressed

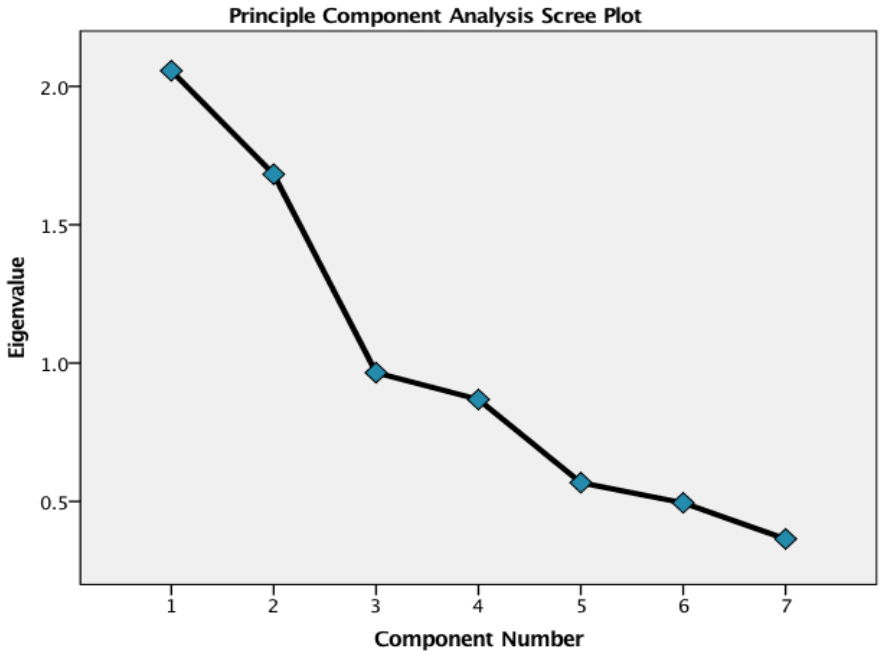

Figure 2.3: Above is the Scree Plot of Factor Analysis displaying the Eigenvalues of the components. Components one and two are used as factors in follow-up analyses.

2.5.6 Including Culture and Time Personality Factors in Delay Discounting Differences in Present and Future Frames across Country

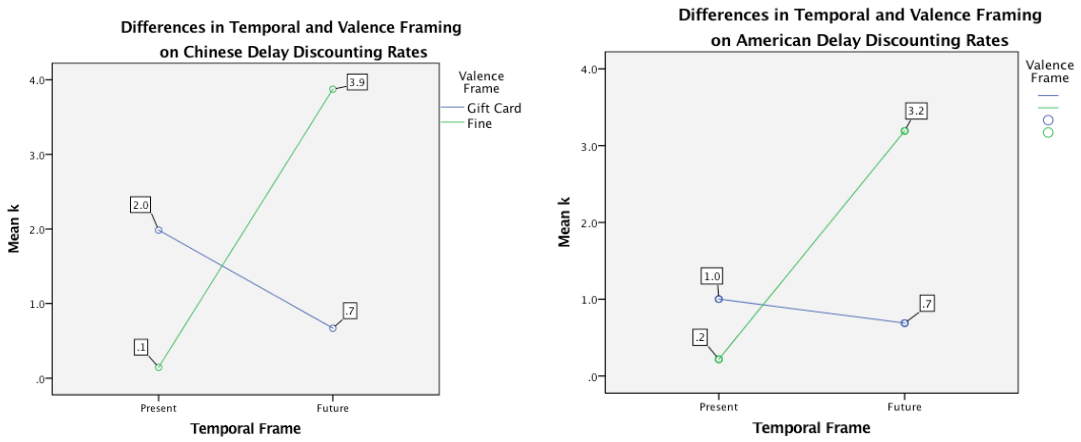

Figure 2.4: This figure shows the 2 (Country: U.S., China) by 2 (Time: Present, Future) by 2(Valence: Gain, Loss) ANOVA with the Culture and Personality Trait factors from the Principal Component Analysis included as co-variates.

The 2 x 2 x 2 ANOVA (Country: China, U.S.; Frame: Present, Future; Valence: Gain, Loss) on the delay discounting rate including the Culture factor and Personality factor from the PCA as covariates still showed a main effect of Country ($F(1,598)=11.924$, $p=0.001$), Time ($F(1,598)=97.770$, $p=0.000$) and Valence ($F(1,598)=268.247$ $p=0.000$), with a two-way interaction of Time and Valence ($F(1,598)=720.448$, $p=0.000$), and a three-way interaction of Country, Time, and Valence ($F(1,598)=32.091$, $p=0.000$). Culture or Personality are not significant co-variates. Interactions between Country and Time or Valence is also not significant. The R-Squared of this ANOVA is 0.660 and the adjusted R-Squared is 0.655.

This non-significance of the Culture and Personality factors a covariate demonstrates that the three-way interaction of Country, Time, and Valence is not dependent on personal cultural or time personality traits. This finding lends further evidence to the hypothesis that delay discounting differences are influenced differences in decision environments and not individual differences in personality traits or socio-cultural orientation.

2.6 Discussion

The current study showed the following main findings: 1) differences in delay discounting by Country 2) differences by Country across the Temporal frame, 3) differences by Country across the Valence frame, and 4) these findings remained significant when controlling for individual differences in socio-cultural orientation and time perspective. In this experiment, the results show a repeated finding that the mean delay discounting rates are significantly different between the two Countries, specifically within the present gain condition and future loss condition. Additionally, the sign effect (Thaler et. al, 1981; Applet et. al, 2011) was replicated, and the degree of this sign effect is significantly different across the two countries. All of these differences in mean delay discounting rates remain significant after controlling for age, cultural differences and personal trait differences, suggesting that the effect of country is driving this effect

These differences in delay discounting across country suggest that temporal-based reward decisions are made differently across countries with

different economic and social environments. For the gain domain, the Chinese participants were more impulsive (M= 2.1) than the American participants (M= 0.7) for the present priming condition ("Would you prefer a fixed amount ($50) today or a variable amount in the future ([$40-$90])?"). Both countries treat gains in the future with the same delay discounting rate (China: M= 0.18, USA: M= 0.19), showing that both groups are more willing to wait for a future reward when the choice starting point is set in the future. For the loss domain, the U.S. and Chinese participants have the same delay discounting rate for fines framed in the present (China: M=0.7, USA=0.66). (Would you prefer a fixed fine today ($45) or a variable amount fine ([$35, $85]) three months from now?). The Chinese and American participants had different delay discounting rates for fines framed in the future (Would you prefer a variable amount fine ([$35, $85]) three months from now or fixed fine ($45) today?). Americans had a lower delay discounting rate (M= 3.13) for future fines compared to the Chinese (M= 3.9). This suggests that Chinese participants would rather pay off debt sooner than American participants when the choice starting point is set in the future. This increase in Chinese delay discounting rates may reflect incorporation of knowledge about the rapidly rising inflation rates and currently fluctuations which would cause debts to be higher cost in the future.

The role of rate of growth could be driving these changes in decision-environment which is reflected in the differences in delay discounting rates. For instance, the Chinese economy has maintained 10% GDP average growth rate

over the last ten years (The World Bank, accessed 10/15/2018), while the United States has maintained a 2-3% GDP growth rate (The World Bank, accessed 10/15/2018). Additionally, the Chinese industries have experienced tremendous growth over the past decade which has resulted in higher average disposable incomes and more access to commercial products (Fung et. al, 2010; Bingxi & Lijuan, 2009; Meng 2004; Farrell et. al, 2006). This is in contrast to the U.S., which has maintained a constant rate of growth over the past 20 years (FRED, accessed 10/15/2019) and experienced a severe economic recession from 2008 to 2013.

Overall, this experiment provides significant evidence for differences in delay discounting rates across two very different economic systems. These differences in delay discounting are most sharply observed for present gain and future loss conditions, suggesting, that these choices are most effected by temporal and valence framing. This effect of framing may be evoking different future prospects and expectations about the future environment, which results in a difference in inter-temporal choice across the two countries. Further cross-cultural research is needed to identify what differences in neural circuitry activation is causing this difference. As well as if these effects can be predicted by public economic information on inflation and GDP/capita growth rates.

CHAPTER 3

COMPARING DELAY DISCOUNTING BEFORE AND AFTER A MAJOR SOCIOPOLITICAL EVENT

3.1 Literature Review

In a democratic republic like the United States, politicians and political parties have tremendous power to shape the social, cultural, and economic environment of the country. This influence is executed via their power to create, amend, and end public policies; appoint judges, agency executives, and cabinet officials; as well as influence social and cultural narratives with their campaigns and public speeches. Since all political actions require majority vote to pass, the two major parties (Democrats and Republicans) need to ensure congressional majorities to pass their agendas. This need for a majority makes U.S. Elections integral to both the short-term and long-term direction of future environment of U.S. Elections happen every two years for various positions. The most recent elections are the 2016 Presidential Election, the 2018 Midterm Elections, and the upcoming 2020 Presidential Election.

The 2018 U.S. Midterm Elections had the highest voter turn-out in over 100 years with just over 49% of the country voting (AP News). In the months leading up to the elections, cable news channels made Midterm Elections coverage a constant media spectacle. Including a live non-stop coverage of Election Day on major news channels, a decision typically used only for Presidential Elections (for a detailed review of how each outlet covered the

election, see the “Here’s How TV, Digital News Outlets Are Covering Midterm Elections Day”, *AdWeek*). A day prior *FiveThirtyEight* published a viewing schedule of when the polls would close, and MSNBC even used their access to Rockefeller Plaza to project the election results on the ice rink (*CCN*). This increased attention and social weight given to the 2018 Midterm Elections made the event a good socio-political event to use in this experiment. Additionally, the smaller scale of this set of elections makes it an ideal way to attain pilot data and see if this experiment should be re-run during the 2020 Presidential Campaign and Election.

There is previous literature showing that humans have neurobiological responses to American elections. In 2008, researchers from Duke University and University of Michigan took four cortisol samples on the night of the 2008 Presidential Election, once before, once during the results announcement and two after the results were announced. The results showed a significant increase in cortisol levels for Senator McCain voters and a significant decrease in cortisol levels for President Obama voters after the announcement (Stanton et. al, 2009). These results show that McCain voters had an increased stress response compared to Obama voters after the election results, providing evidence that socio-political events can have a significant effect on the human stress response.

Additionally, a study from UCLA showed that participants experiencing election-related distress and depression in the four months after the 2016 U.S. Presidential Election showed differences in stress-related reward processing

compared to participants who did not experience distress (Tashjian & Galvan, 2018). This fMRI paradigm investigated the mesolimbic reward circuit, focusing on the NAcc and mPFC, and the circuit's response to reward anticipation and loss. Activation in the NAcc was shown to significantly moderated the relationship between depression and the election stress. Overall, the study showed that political events can significantly affect the mesolimbic circuit and cause differences in reward and loss processing.

In this experiment, I will be testing delay discounting rates before and after the 2018 Midterm election to examine how an external change in the socio-economic environment effects changes in intertemporal choices. I will also test if these differences before and after the election group are specific to certain political identities and income groups. I expect that the outcome of the Midterm Election will change participants' perception of future perspective due to the change in administration. This difference in future perception will create changes in an individual's thoughts about their future as well as their measures of delay discounting. I expect that these effects of election will be modulated by an individual's political and economic standing within their current decision environment.

There are no experiments looking at the relationship between trust in political institutions and changes in delay discounting. However, it follows similar logic to the previous chapter's economic uncertainty argument that political uncertainty would also result in changes to monetary decision making. Since all

global markets rely on the decisions of political institutions to set the rules and intervene during bad economic times, it makes sense that having trustworthy and dependable leaders making these decisions will influence economic decisions. This set of experiments is aimed at determining the link between political change to changes in delay discounting. Such that, the losing political identity should increase (become more impulsive) and the winning political identity should decrease (become less impulsive) after the set of elections.

Another aspect of the environment closely associated with the income level is the amount of access you have to environmental resources. This level of resource scarcity in an environment can be measured in current socio-economic status and the socio-economic status a person experiences growing up. There is significant evidence showing that lower socioeconomic status individuals have higher delay discounting rates and lower risk tolerances than higher socioeconomic status individuals (again, for a review please see Shafir (2017) and Kish-Gephart (2017)). As well as evidence that exposure to high levels of economic uncertainty during childhood, such as growing up during the Great Depression, shapes life-long financial risk tolerances to be more conservative and myopic (Malmendier & Nagel, 2009). This effect of environment and resource scarcity influencing myopic decision making has been previously discussed in Section 1.4.

In this experiment, I will investigate if the effects of the Midterm Election across socioeconomic status. As delay discounting differ across and can be

affected by economic status, it is also plausible that the different socioeconomic groups will be affected by the Midterm Election separately. Specifically, that the higher income individuals will be more affected by the election and the effect the election has on future prospects because higher income individuals show higher generalized trust and reliance on the future than lower income individuals.

In this experiment, I first collected the participant's baseline delay discounting rates as well as survey items that gathered information on their demographics, perception of risk in the world around them, and how they interact with actors within their environment. Next, to test if self-projection into the future changes delay discounting rates, I had participants think towards their future and write a brief paragraph describing the future they envisioned 10 years from now. After this projection, the delay discounting rate was collected again. This projection procedure was used to prime the participants to envision their future before having them make a series of intertemporal choices. The difference in delay discounting rate between the two time points were compared by Election Group (Before and After) , the political parties and income levels. We also analyzed the specific contents of the paragraphs provided by the participants to measure qualitative and quantitative differences in valence of the participant's future perspective.

I anticipate that the direction of delay discounting change, if it occurs, will follow political party identity and the outcome of the election. For example, if you're very liberal and very dissatisfied with the current conservative

government, you will have greater increase in delay discounting from baseline, compared to conservatives, when projecting towards the future before the 2018 Midterm. After the midterm election, if the liberal party wins control of one or both of the houses of congress, the liberals' delay discounting rates would show greater decrease from baseline, compared to conservatives, when projecting towards the future.

Additionally, I anticipate that the direction of delay discounting change, if it occurs, will follow income groups and the outcome of the election, with the upper middle- and upper-class groups being more sensitive to changes in future perspective. These groups will have higher sensitivity to these election results and their implications for the future perspective due to the higher levels of general trust and future orientation that exist in higher income individuals.

3.2 Hypothesis and Predictions

I hypothesize that the groups tested before and after the 2018 Midterm Elections will have different delay discounting rates because the sociopolitical environment will have changed, which creates different perspectives on one's future. I predict that the differences in delay discounting rates will depend on the outcome of the elections, the way in individual perceived one's future in reference to the election outcomes, their political party, income group, and level of concern about the future direction of the country. Overall, predict that if a participant envisions a more negative future, their delay discounting rate will increase due to them becoming more myopic. My political identity group

prediction is that participants' delay discounting rates will increase (become more impulsive and myopic) if their political party loses and decrease if their political party wins. My income group prediction is that there will be differences in delay discounting rates across income level, with higher incomes showing more change due to their increased freedom and access to resources. In this line, I hypothesize that lower income individuals will be less effected by the Midterm Elections because lower income groups are less reliant on the future when making inter-temporal choices. Overall, I am also aware that these effects could be more muted than results seen in a Presidential campaign because the Midterm Elections are an aggregation of hundreds of events, while the Presidential election is a stochastic event.

As a way of measuring how one's future is envisioned, individuals were asked to project toward their future and write a brief paragraph describing it. If present environment informs future projections, the normalized negative thought ratio should be lower for Post-Midterm participants than Pre-Midterm participants (less dominated by negative thoughts), assuming that the U.S. Midterm Election outcome makes the participants feel more positive about the present. This difference in normalized negative thoughts should also follow a political party identity pattern. Overall, the k differences for each k level should be predicted by normalized negative thought ratios for future projection.

3.3 Methods

3.3.1 Participants

Undergraduate students were recruited through SONA, the UMass Amherst research participation platform (N=270, M= 20.01, males =53). Participants who fully completed the survey were granted one SONA credit, and participants who did not finish were not granted credit. The Pre-Midterm Election survey (n= 105, M = 20.05, males = 17) was posted to the SONA system via Qualtrics two weeks before election day. The Post- Midterm Election survey (n = 165, M =19.98, males = 53) was posted to the system one week after the 2018 Midterm Elections and remained open for two weeks.

Participants were enrolled in the study based on their date of sign-up and had access to the survey for 5 days after the link was opened. Once this deadline passed, the survey link expired and Qualtrics submitted the latest version of the survey. No participants were allowed to take both the Pre-Midterm and Post-Midterm surveys and no participants were directed to take a specific survey. The overall completion rate was 89.3% of participants. The Pre-Midterm survey enrolled 105 participants, with 95 participants completing the survey (90.5% completion rate) and the Post Midterm survey enrolled 165 participants, with 146 participants completing the survey (88.5% retention rate*).*

Participants were included for analysis if their delay discounting rate was internally consistent (a measurement in Kaplan Auto-scorer, 2016), provided the written priming paragraphs with valid, consistent responses, and finished the survey. A valid and consistent priming response was judged by undergraduate research assistants who assessed if the participant legitimately responded to the

prompt and did not input random words or characters to meet the character limit. The scoring methods for this analysis is described in the next Section (Section 3.3.2). When these filters were applied, this further excluded 15 participants (7 from Pre-Midterm group and 8 from Post-Midterm group) to create the final groups of Pre-Midterm (n=88, M= 20.07 yrs, SD= 2.201, males= 13) and Post-Midterm (n=138, M=20.12 yrs, SD= 1.178, males= 34) participants. The final sample size is (N= 226, M= 20.10 yrs, SD= 1.65, males = 47). The political and economic breakdown of the sample is shown in Table 3.1.

Table 3.1: Sample Sizes of Sample, Political Groups, and Income Groups

	Pre-Midterm (n)	Post-Midterm (n)	Total
Liberal	45	77	122
A Mix	21	34	55
Conservative	5	4	9
No Party	17	23	40
Lower Class	15	18	33
Lower Middle Class	26	31	57
Upper Middle Class	33	62	95
Upper Class	14	27	41
Total	88	138	226

3.3.2 Survey Design

Both surveys had the same layout and order of questions, but the Post-Midterm survey included three additional questions on opinions about the elections and voting behavior. The survey began with a consent form, demographic questions (age, gender, hometown, employment, education level), and economic backgrounds questions to attain socio-economic status. Next, the political identity questions were taken from PEW research (Pew Research Center, 2014) questionnaires covering political identity, changes in political

interest, and level of political interest. Then the participant completed the 27-item Monetary Choice Questionnaire, a survey item with twenty -seven intertemporal choices with varying lengths of time and reward differences, which measures delay discounting (Kirby et. al, 1999), Consideration of Future Consequences Scale (Strathman et. al, 1994) which measures how the participant considers future consequences of present actions, and the Barrett Impulsivity Scale (BIS-11) (Patten et. al, 1995) which measures trait impulsivity. Participants were then asked to rate how fast they felt the world was moving 10 years ago, and how fast the world feels like it's moving now (negative or positive on a continuous sliding scale between 0 and 100), as well as what direction the world has changed over the past five years. This section was followed by PEW questions on trust in others, trust in leaders, in-group feeling, and general concerns for the future (Pew Research Center, 2017). Finally, for the Post-Midterm survey, there were questions regarding the outcomes of Midterm Election, then on both surveys there was the priming task, in which participant are asked to provide written responses as described in detail below. After the priming task, the participants re-took the 27- item Monetary Choice questionnaire.

The priming task consisted of two sequential writing prompts that each required 1000-character responses (about 5 to 7 sentences). The first prompt asked the participant to consider the world around them in present and to include any significant events that had happened in their day or week. The second prompt asked the participant to consider the world 10 years from now and

explain what they saw happening around them in terms of economic, political, environmental, and social future. For the post-midterm survey, the second prompt used the same language, but specified that participants should incorporate the outcome of the 2018 Midterm U.S. Elections as he or she projected into the future.

We used the priming task as a procedure to prime the participants to think about their expectations and the contents of the future. This projection was analyzed to see if the participant intrinsically projected to a positive or negative future, as well to what degree their future had a particular valence (ie, strongly negative, strongly positive, neutral, weakly positive, weakly negative). The specific contents of the participants' thoughts about the future were used a metric about the participant's expectations of their future environment (scoring and calculations are described in Sections 3.4.1 and 3.4.2).

3.3.3 Group Specifications

Political Identity and Income classes are the two participant groups that are used in this analysis. The Political identities are Liberal, A Mix, Conservative and No Party. These measures were self-reported on the survey. For the purpose of these analyses, any ANOVA with Political Identity will not include "No Party" participants because it is unclear what lead them to have no party.

Income Groups are sorted by the response to the comparative income scale item which asked the participant to rank their family's income from 1 to 10 relative to others. The correlation between the comparative income scale and the

average income scale which reports their income range is significant (r =0.767, p= 0.000, N= 227). The income groups are created based on collapsing across the ten comparative income groups to make four income groups (Lower Class: Comparative Income =1, Comparative Income =2, Comparative Income= 3; Lower Middle Class: Comparative Income =4, Comparative Income =5; Upper Middle Class: Comparative Income=6,Comparative Income =7; Upper Class: Comparative Income= 8, Comparative Income = 9, Comparative Income = 10).

3.4 Analysis

3.4.1 Calculations and Variables

3.4.1.1 Delay Discounting

The 27-item monetary choice questionnaire delay discounting rates were calculated using the 27-item MCQ auto-scorer public Excel workbook (Kaplan et. al, 2016). Using the scorer, each participant is given a small k (small time gap, small reward difference), medium k (medium time gap, medium reward difference), large k (large time gap, large reward difference)), and overall k (combination of all time and reward differences). This experiment reports all four delay discounting rates given by the auto-scorer because each level measures a different range of reward trade-off. The overall k rate is a participant's overall rate, or a combination of the small, medium, and large trade-off decisions. By reporting all four rates, it can be observed if certain trade-off decisions are more affected by the future priming. Participants were excluded if their internal

consistency was below 75% (metric calculated by Kaplan auto-scorer public access Excel spread sheet).

In this experiment we have two measurements of delay discounting. To collapse into one measurement, the delay discounting rate collected before the priming task was subtracted from the rate collected after the priming task. This difference measure is used because it corrects for individual differences in delay discounting and measures the pure difference within the subject. Using this difference gives us a change in delay discounting relative to each participant's relative baseline delay discounting rates. This difference measure is calculated for all four levels of k. All measures of k are reported because they test different levels of temporal delay or reward size. Reporting the small, medium, and large delay discounting rates will reveal the trends of the overall delay discounting rate, as well as if a certain temporal sub-scale is more susceptible to priming.

3.4.1.2 Normalized Negative Thought Ratios (NNR)

The normalized negative thought ratios (NNR) were taken by subtracting the overall number negative thoughts from the overall number of positive and neutral thoughts and dividing by the total number of thoughts (Eq. 3.1). This ratio is calculated for the present and future priming response, creating two ratios per participants. Additionally, to ensure that the Future Valence captures the same metric as the NNR, a bivariate correlation between the two was completed. There is a high correlation between the averaged Future Valence score and the future

normalized negative thought ratio (r = -0.805, p = 0.000, n= 226). Due to this high correlation, both measurements should have similar results.

$$\text{Eq. 3.1:} \quad \text{ratio} = \frac{\#negative - (\#positive + \#neutral)}{\#negative + \#poitive + \#neutral}$$

3.4.2 Future Perspective Scoring

Each set of responses were scored by two separate undergraduate research assistants. The responses were first scored by counting the number of positive, neutral and negative phrases. Then, two separate research assistants read the responses and gave the response an Overall Valence score from 10 to -10; with 10 being extremely optimistic and positive, and -10 being extremely pessimistic and negative. These valence scores were averaged for each prime in the priming task set.

3.4.3 Analysis Plan

In this analysis section, I will run three main analyses. The first is an analysis to test differences in future perspective and delay discounting rate before and after election groups (Section 3.5.2). This will test for any differences in purely the election group. In the other two analyses, I will test for differences within political identity and income group before and after the election. In my second, I will test for differences in future perspective and delay discounting rate across political identity by election group (Section 3.5.3). Finally, in my third analysis, I will test for differences in future perspective and delay discounting rate across income group by election group (Section 3.5.4). In each analysis, I will

begin with an ANOVA of Future Valence and future normalized negative thought ratios (NNR Future) followed by independent sample t-tests to test for differences within Political Identity and Income Group across the Election Group. This same analysis technique of an ANOVA followed by independent sample t-tests will be conducted for each level of delay discounting (overall, small, medium, and large). In all ANOVAs, Election Group, Income Group, and Political Identity are treated as fixed factors. I hypothesize that there will be differences across the Election Groups in all measures because the Midterm Election will have changed the participant's decision-environment. I predict that differences in all measures will be observed, but that these differences will be more pronounced within specific Political Identities and Income Groups.

3.5 Results

3.5.1 2018 U.S. Midterm Election Political Results

The 2018 U.S. Midterm Election broke a 50-year record (49% in 1966) for voter turnout, with levels of participation usually seen for Presidential Elections (*NPR, accessed 5/20/2018*). This Election had a turnout of 47.5%, up from 36.7% in 2014 (*NPR*, 11/8/2018). Previous to this Election, the House of Representatives was comprised of majority Republicans (Democrats: 194, Republicans: 241) and the Senate was comprised of majority Republicans (Democrats: 48, Republicans: 52) (*Associated Press, accessed 5/20/2018*). After the Election, the House of Representatives went from a Republican majority to a

Democratic majority (Democrats: 235, Republicans: 199) (*Associated Press, accessed 5/20/2018)*.

This 41-seat pick-up in the House of Representatives caused a large change in the Unites States leadership infrastructure. Prior to election night, the odds of this pick up in House of Representatives and Senate was (7 in 8 and 1 in 5, respectively) (*FiveThirtyEight, last updated 11/6/2018 at 11:06am).* The series of election victories triggered a change in House Leadership where Nancy Pelosi (D-CA) was named Speaker of the House and all HOR Committees became chaired by Democrats. The Senate control was still maintained by the Republicans (Democrats: 47, Republicans: 53) (*Associated Press, accessed 5/20/2018*) and the party leadership did not change, with Mitch McConnel (R-KY) remaining the Senate Majority Leader. In general, this set of elections is considered a win for Democrats because Republicans lost control of one house of Congress and no longer controlled both houses and the Presidency.

3.5.2 Analysis by Election Group

Before checking for differences in delay discounting across the Political Identities and Income Groups, I first wanted to look at the overall effect of Election Group on future environment perception and delay discounting. To do this, I first tested for differences in Future Valence and NNR future across the two Election Groups using a one-way ANOVA with Election Group as the factor. Then I tested for differences in delay discounting across the Election Groups using the same one-way ANOVA with Election Group as the factor.

3.5.2.1 Differences in Future Perspective Across Election Group

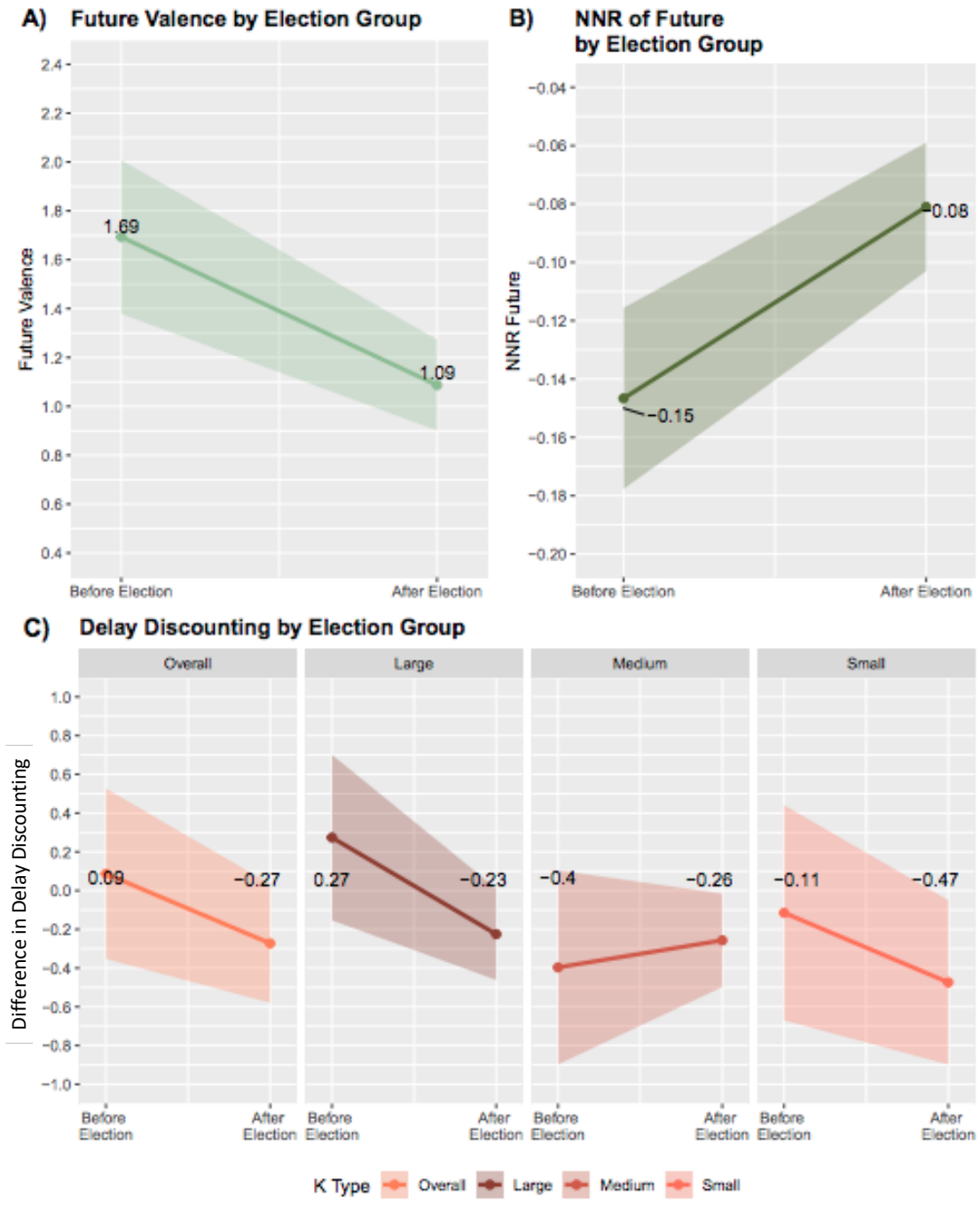

Figure 3.1 This figure shows differences in (a) Future Valence, (b) NNR Future, and (c) all four levels of delay discounting rates within Election Group. Error bars represent SEM for each condition and group.

To test for differences in future perspective, an ANOVA on Future Valence and NNR Future was completed. A one-way ANOVA of Election Group (Before Midterm, After Midterm) completed for Future Valence revealed a non-significant main effect of Election Group ($F(1, 185) = 1.926$, $p = 0.0167$, observed power = 0.282). (Please see Figure 3.1a). A one-way ANOVA of Election Group (Before Midterm, After Midterm) completed for NNR future revealed a non-significant main effect of Election Group ($F(1, 185) = 2.534$, $p = 0.0113$, observed power = 0.353). Overall, there is a trend towards significance across these two groups, suggesting that a deeper analysis should be conducted to see if a certain group is driving this difference (Please see Figure 3.1b).

3.5.2.2 Differences in Delay Discounting Across Election Group

For overall k, there was no main effect of Election ($F(1,186) = 1.012$, $p = 0.316$, observed power = 0.170). For small k, there was no main effect of Election ($F(1,186) = 0.821$, $p = 0.366$, observed power = 0.147). For medium k, there was no main effect of Election ($F(1,186) = 0.138$, $p = 0.710$, observed power = 0.066). For large k, there was no main effect of Election ($F(1,186) = 1.435$, $p = 0.233$, observed power = 0.222). (Please see Figure 3.1c).

Each of these analyses show that there are no Election Group differences for any level of delay discounting. However, this analysis does not show if there are differences within each Election Group that cancel each other out and result in a non-significant main effect. In order to test this, the analysis needs to be repeated to include the other identity factors which could result in Election

differences. These analyses should be repeated with an additional factor of Political Identity and Income Group to sparely test for differences based on the main effect of the identity factors and interactions between Election Group and the identity factors.

3.5.3 Analysis by Political Identity and Election Group

Next, I was interested in testing if there are differences across Political Party in the measurements taken before and after the election. To test for these differences, I first looked at the overall effect of Election Group on future environment perception and delay discounting within each Political Identity. To do this, I first tested for differences in Future Valence and NNR future across the three Political Identities and two Election Groups using a 2x3 ANOVA (Election Group: Before Midterm, After Midterm; Political Identity: Conservative, A Mix, Liberal). Then I tested for differences in delay discounting across the Election Groups using the same 2x3 ANOVA (Election Group: Before Midterm, After Midterm; Political Identity: Conservative, A Mix, Liberal).

3.5.3.1 Differences in Future Perspective Across Political Identity by Election Group

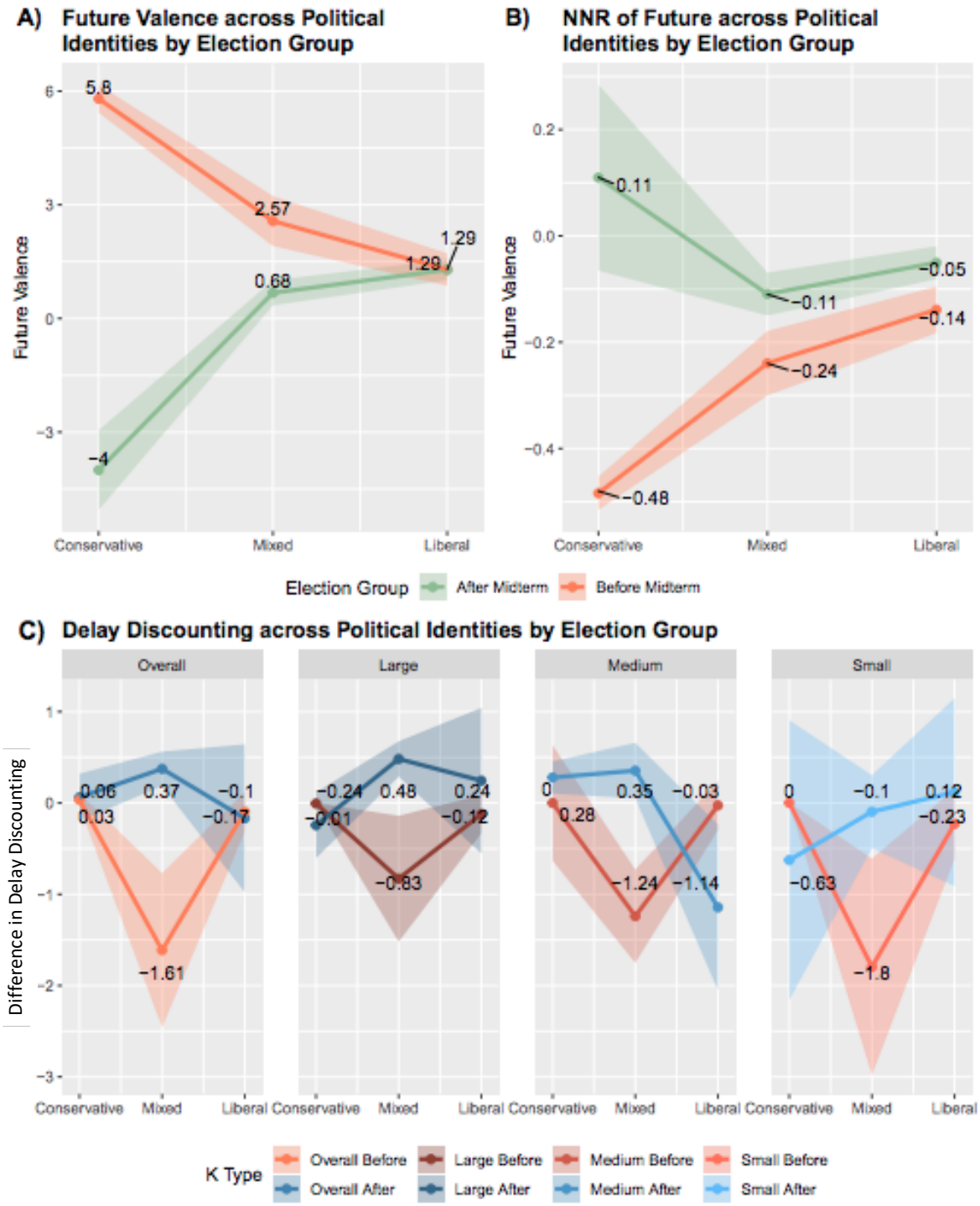

Figure 3.2: This figure shows differences in (a)Future Valence, (b)NNR Future, and (c) all four levels of delay discounting rates within each Political Identity and by Election Group. Error bars represent SEM for each condition and group.

I first determined if the participants had different projections into the future based on their political identity by comparing the Future Valence score and the future NNR scores from the priming written responses across Election and Political identity groups. A 2x3 ANOVA (Election: Pre-Midterm, Post-Midterm; Political Identity: Liberal, A Mix of Both, Conservative) on Future Valence score showed a significant main effect of Election Group ($F(1, 185) = 9.654$, $p = 0.002$) and a significant interaction between Election Group and Political Identity ($F(2, 185) = 4.175$, $p = 0.017$). The main effect of Political Identity was not significant ($F(2, 185) = 0.121$, $p = 0.886$). This interaction between Election Group and Political identify shows that the means of Future Valence are different for each political identity and that these differences within each political party are also different across Election Group. To test what groups are driving this interaction, I must test for differences in Future Valence within each political identity across Election Group separately. This analysis of Future Valence can be viewed in Figure 3.2a.

To follow up on the interaction between Political Identity and Election group, I ran a series of independent samples t-tests to look at the difference in Future Valence before and after the 2018 Midterm Election within each Political Identity group. An independent samples t-test for the Conservatives confirmed a significant difference in their Future Valence before ($M = 5.4$) and after ($M = -4.0$) the election ($t = 4.354$, $df = 7$, $p = 0.003$). These findings are not significant for the Mixed and Liberal participants. Mixed participants had no significant difference

between Pre- and Post-Midterm Future Valence (t= 1.267, df= 30, p= 0.215). Likewise, the Liberal participants showed no difference in the two measures (Future Valence: t =0.003, df= 121, p= 0.997). These comparisons show that Conservatives have the most significant difference in the valence of their thoughts before and after the Midterm Elections, for the future environment. Additionally, Conservatives changed from having a positive future perspective before the Midterm Elections to having a negative future perspective after the Midterm Elections. However, due to the very small Conservative sample size, more participants are needed before this statistic accepted with high certainty. Although, this drastic of a change in future perception did not occur for the other two parties.

A similar analysis was performed using the normalized ratio of negative thoughts (NNR future) in the priming written responses This analysis was completed to test another metric of perception of future environment. A 2x3 ANOVA (Midterm: Before Election, After Election; Political identity: Liberal, A Mix of Both, Conservative) on NNR future yielded a significant main effect of Election Group (F (1, 185) =3.937, p=0.049) but did not have a main effect of Political identity (F (2, 185) =0.446 , p=0.641) or the interaction between Political identity and Election Group (F (2, 185) =0.882 , p= 0.416). This analysis reveals that the main effect of Election Group is still present in this second measure of future perspective, but that the main effect of Political Identity or the interaction between the who factors is not significant. Additionally, this effect of Election Group shows

that participants, overall, became more negative about the future after the election. Graphically, this effect seems to be heavily driven by the Conservatives' mean. This analysis can be viewed in Figure 3.2b.

Overall, these results show that the Election Groups significantly differ in their perception of the future environment when Political Identity is included as a factor. There is also evidence of the Political Identities having different perceptions of the future environment, with the Conservatives driving this group effect of being more negative about the future environment after the Midterm Election.

3.5.3.2 Differences in Delay Discounting Across Political Identity by Election Group

In this next set of analyses, I have followed up on the finding that perception of the future is different between the Political Parties. I tested if this difference in future perspective coincides with changes from a participant's delay discounting baseline rate after projecting into future. To do this, I tested if the difference in delay discounting from baseline and after self-projection across the Political Identity and Election groups. I tested differences at each temporal level of k to see which is the most susceptible to change from baseline after self-projection. I utilized a series of 2x3 ANOVAS (Election: Before Election, After Election; Political Identity: Conservative, A Mix, Liberal) on k difference were to test for differences in delay discounting across Political Party by Election Group. This ANOVA was run separately for each level of delay discounting.

The analysis of overall k revealed no main effect of Election (F(1,186)=0.506, p= 0.478, observed power = 0.109), Political Party (F(2,186)=0.354, p= 0.702), observed power = 0.106) or the interaction (F(2,186)= 1.446 p= 0.238, observed power = 0.307)) between Election Group and Political Identity. The analysis for small k revealed no main effect of Election (F(1,186)=0.139, p= 0.709, observed power = 0.233), Political Party (F(2,186)=0.553, p= 0.576), observed power = 0.141) or the interaction (F(2,186)= 0.401 p= 0.670, observed power = 0.114)) between Election Group and Political Identity.. The analysis for medium k revealed, no main effect of Election (F (1,186) =0.077, p= 0.781, observed power = 0.059), Political Party (F (2,186) =0.174, p= 0.840), observed power = 0.077). However, a trend for a significant interaction between Election Group and Political Identity was observed (F (2,186) = 2.494 p= 0.085, observed power = 0.496). Finally, the analysis for large k revealed no main effect of Election (F(1,186)=0.321, p= 0.571, observed power = 0.110), Political Party (F(2,186)=0.089, p= 0.915), observed power = 0.063) or the interaction (F(2,186)= 0.428, p= 0.652, observed power = 0.119)) between Election Group and Political Identity. Overall, there is only evidence for the presence of an interaction between Election Group and Political Identity within the medium k domain. The graphs of these analyses for each delay discounting rate can be found in Figure 3.2c.

Next, the question is if specific Political Identities have differences in delay discounting after self-projection before and after the election. To investigate if

there are differences before and after the election within each political identity, I ran a series of independent t-tests. These t-tests were conducted for each level of delay discounting. These independent t-tests revealed that the conservatives did not show any significant differences across overall k (df= 7, t=0.266, p= 0.927), small k (df= 7, t=0.073, p= 0.729). medium k (df= 7, t=0.474, p= 0.650), or large k (df= 7, t= -0.582, p= 0.579). As well as the liberals who also did not show any significant differences across overall k (df= 120, t= -0.106, p= 0.916), small k (df= 56.784, t=0.316, p= 0.753). medium k (df= 51.784, t= -1.180, p= 0.243), or large k (df= 120, t= 0.550, p= 0.584). However these independent t-tests revealed that the mixed identity showed significant differences across overall k (df= 36.208, t=2.300, p= 0.027) and medium k (df= 50.171, t=0.2.684 , p= 0.010), but did not show difference for small k (df= 40.059, t=1.359, p= 0.182 or large k (df= 37.968, t= 1.833 , p= 0.075). Overall, this provides evidence for the Mix identity's chance in delay discounting rates being the most affected by the Election, with a specific change in overall and medium k domains but not small and large k domains.

3.5.4 Analysis by Income Group and Election Group

Next, I was interested in testing if there are differences across Income Group in the measurements taken before and after the election. To test for these differences, I first looked at the overall effect of Election Group on future environment perception and delay discounting within each Income Group. To do this, I first tested for differences in Future Valence and NNR future across the

four Income Groups and two Election Groups using a 2x4 ANOVA (Election Group: Before Midterm, After Midterm; Income Group: Lower Class, Lower Middle Class, Upper Middle Class, Upper Class). Then I tested for differences in delay discounting across the Election Groups using the same 2x4 ANOVA (Election Group: Before Midterm, After Midterm; Income Group: Lower Class, Lower Middle Class, Upper Middle Class, Upper Class).

3.5.4.1 Differences in Future Perspective Across Income Group by Election Group

Next, I was interested in seeing if these changes in future perspectives based on election outcomes are also found across the income levels. To do this, I repeated the analysis comparing the Future Valence and NNR future scores across Income groups and Before and After the elections. First to test if the Future Valence is different across the Income Groups, a 2x4 ANOVA (Election Group: Pre-Midterm, Post-Midterm; Income Group: Lower Class, Lower Middle Class, Upper Middle Class, Upper Class) on was completed. This ANOVA did not show a significant main effect of Election Group ($F(1,226) = 1.613$, $p=0.205$), Income Group ($F(3,226) =1.389$, $p=0.247$), or an interaction between Election Group and Income Group ($F(3,226) =1.197$, $p=0.312$). This demonstrates that there is no difference in Future Valence Before and After the election, as well as across the Income Groups. However, it is still important to check if there are differences in Future Valence within each Income Group separately. Please see Figure 3.3a for results of this analysis.

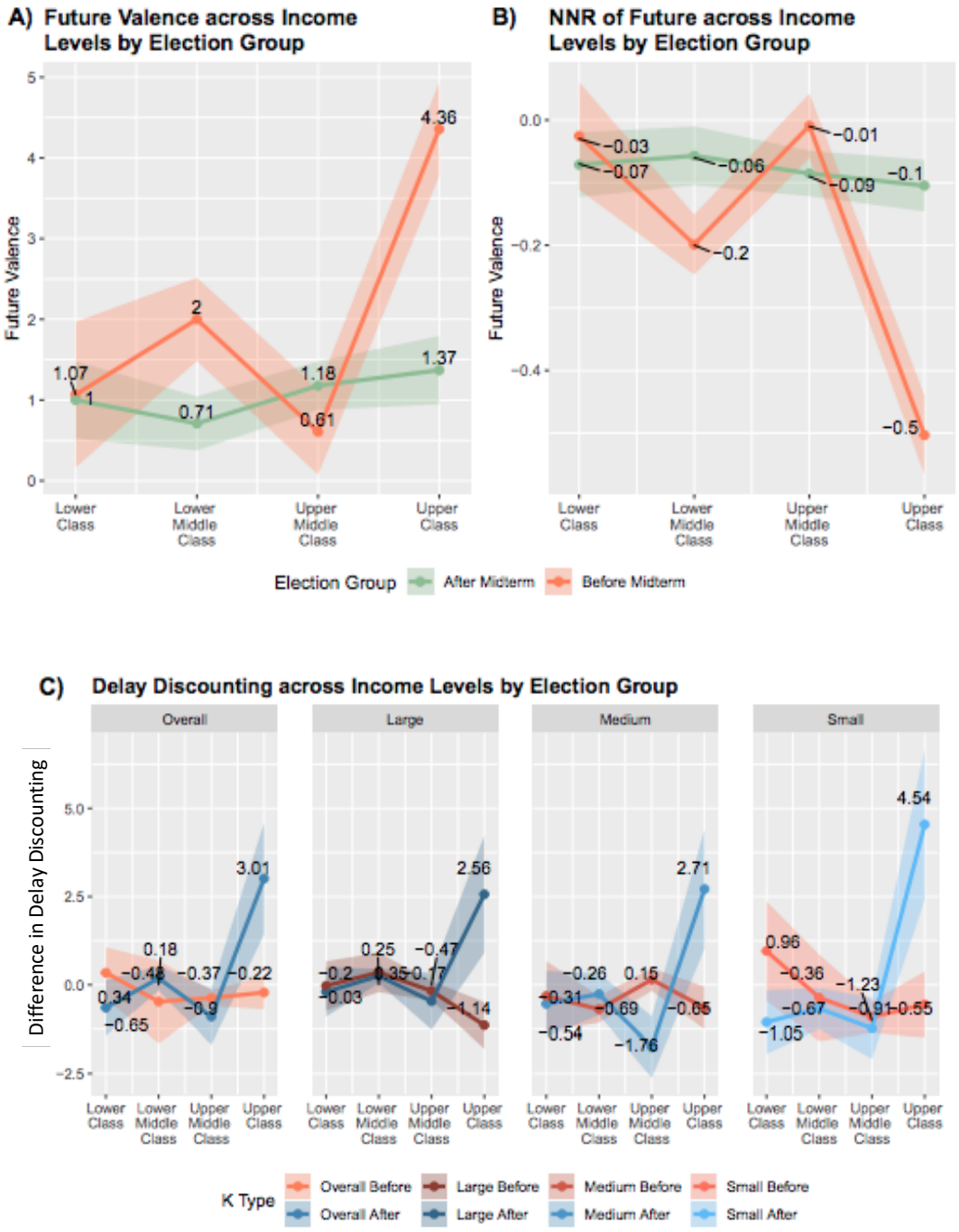

Figure 3.3: This figure shows differences in (a)Future Valence, (b)NNR Future, and (c) all four levels of delay discounting rates within each Income Group and by Election Group. Error bars represent SEM for each condition and group.

To test if there is a difference within Income Group, as there was with Political Identity, I completed a series of independent samples t-tests to look at the difference in Future Valence before and after the 2018 Midterm Election. An independent samples t-test for the Upper Class confirmed a significant difference in their Future Valence before (M = 4.357, SD = 1.193) and after (M = 1.370, SD=0.859) the election (t = 2.031, df=39, p =0.049). These findings are not significant for the Lower Class, Lower Middle Class and Upper Middle-Class participants. Lower Class participants had no significant difference in Future Valence before and after the election (t= 0.032, df= 31, p= 0.975). Likewise, the Lower Middle-Class participants showed no difference in Future Valence (t = 1.067, df= 55, p= 0.291). As well as, Upper Middle Class which showed no difference in Future Valence (t = -0.502, df= 93, p= 0.617).These comparisons show that the Upper Class is the only Income Group to have a significant difference in the valence of their thoughts about the future environment before and after the Midterm Elections. This group has a more negative projection of the future after the Midterm Election than the projection before the election.

To test if NNR showed any changes across the election by income group, a 2x4 ANOVA (Election: Pre-Midterm, Post-Midterm; Income Group: Lower Class, Lower-Middle Class, Upper-Middle-Class, Upper Class) on NNR future was completed. The ANOVA on future NNR has a marginally significant main effect of Election Group (F(1,227)=2.121, p=0.098), but does not have a significant main effect of Election Group (F(1,226)=1.716, p=0.192) or an

interaction between Election Group and Income Group (F(3,226)=1.861, p=0.137). This again shows that there is a difference in the contents of future projection between the two election groups, with the after-election projection being more negative than the before election projection. Please see Figure 3.3b for results of this analysis.

Overall, these results show that the Income Groups do significantly differ in their perception of the future environment. There is also evidence of the Income Groups having different perceptions of the future environment with the Upper Class driving the group effect.

3.5.4.2 Differences in Delay Discounting Across Income Group by Election Group

In this next set of analyses, I am testing if Income groups have differences in their delay discounting before and after the 2018 Midterm Election. To do this, I will first test if the difference of the after projection and baseline delay discounting rates is different before and after the 2018 Midterm Election for each income group. If differences are revealed, I will run a set of One-Way ANOVA of difference in delay discounting as a dependent variable and Election group as a factor separately for each Income Group. I will follow up any differences between Election groups will a series of paired t-tests. Finally, I will run Mixed ANOVAs on any Income Groups that are significant in the paired t-tests.

The analysis of overall k revealed there was no main effect of Election (F (1,226) =1.148, p= 0.285, observed power = 0.187). Although there was a

marginally significant main effect Income Group (F (3,226) =2.538, p= 0.058), observed power = 0.621) and an interaction between Income Group and Election Group (F (3, 226)= 2.57 p= 0.055, observed power = 0.627). The analysis of small k revealed there was no main effect of Election (F (1,226) =0.712, p= 0.400, observed power = 0.134). However again, there is a significant main effect of Income Group (F (3,226) =3.389, p= 0.019, observed power = 0.760) and an interaction between Election Group and Income Group (F (3, 226)= 3.661 p= 0.013, observed power = 0.795). A similar result was observed for medium k, with no main effect of Election (F (1,226) =0.618, p= 0.433, observed power = 0.123) but a marginally significant main effect of Income Group (F (3,226) =2.313, p= 0.077), observed power = 0.577) and significant interaction between Election Group and Income Group (F(3, 226)= 4.799 p= 0.003, observed power = 0.899) as well.

Finally, in large k, there was a marginally significant main effect of Election (F (1,226) =2.658, p= 0.104, observed power = 0.368) and a significant interaction between Income Group and Election Group (F (3, 226)= 3.033 p= 0.013, observed power = 0.796)). However, the main effect of Income Group (F (3,226) =1.011, p= 0.389), observed power = 0.273) was not significant. This repeated interaction of Election Group and Income group across all levels of k shows that there are significantly different changes in delay discounting rate from the participant's baseline. This mean difference in k is different for each Income

Group, a well as within each Income Group across Election Group. Please see Figure 3.3c for results of this analysis.

Next, the question is if specific Income Groups have differences in delay discounting after self-projection before and after the election. To investigate if there are differences before and after the election within each Income Group, I ran a series of independent t-tests. These t-tests were conducted for each level of delay discounting. The independent t-tests revealed that the upper middle and upper classes were more affected than the lower and lower middle classes.

Specifically, the lower class did not show any significant differences across overall k (df= 30.025, t= -0.929, p= 0.360), small k (df= 31, t= -1.152, p= 0.258). medium k (df= 30.939, t= -0.167, p= 0.868), or large k (df= 30.668, t= -0.176, p= 0.861). The same pattern was present in the lower middle class who did not show any significant differences across overall k (df= 55, t=0.503, p= 0.617), small k (df= 55, t= -0.212, p= 0.833). medium k (df= 55, t=0.639, p= 0.526), or large k (df=55, t= -0.159, p= 0.874). However, the upper middle class showed a significant difference across medium k (df= 93, t= -2.47, p= 0.015) but did not show difference for overall k (df= 93, t= -0.813 , p= 0.419), small k (df= 93, t= -0.362, p= 0.718 or large k (df= 93, t= -0.425 , p= 0.672). This pattern increased in the upper class who showed significant differences across overall k (df= 39, t=2479, p= 0.018), small k (df= 39, t=2.560 , p= 0.014), medium k (df= 39, t=2.482, p= 0.017 and large k (df= 39, t= 2.482 , p= 0.017). Overall, these analyses reveal that the Income Groups show a significant difference in their

Baseline and After projection delay discounting measurements. The effect of Election Group is most strongly observed in the Upper Income Group, which was predicted by my hypothesis.

3.6 Discussion

Overall, this experiment showed that a major socio-political event can change one's future perspectives and delay discounting rate. Additionally, it was shown that both the degree of change in future perception and delay discounting before and after the election is influenced by one's political identity and socioeconomic status. Future Valence was significantly different between the election groups for Conservative and Upper-Class participants, with Conservatives showing a 10-point decrease in their mean Future Valence after the election. Both groups became significantly more negative after the election, compared to before the midterm.

Delay discounting was significantly different between election groups for the Mixed political identity and Upper-Class income group. These two groups showed the most change from baseline in their delay discounting rates, with the Mix participants becoming less myopic after the election and Upper-Class participants becoming more myopic. While the relationship between higher Future Valence and increased myopic choices was not observed in Conservatives, this pattern was observed in Upper Class group. These results show evidence of future perspective influencing differences in delay discounting, such that if a participant is more concerned about future, more myopic options

will be chosen. This pattern of behavior replicates foraging, and hording behaviors documented in the Incentive Hope Hypothesis and the resource scarcity and decision-making literature.

There are two short comings of this experiment: (a) the different cohorts, which could be causing cohort effects, and (b) the very low number of enrolled conservatives. The cohort effect is an un-avoidable short coming when the experimental design involves collecting data from two different groups. I chose the experimental design with full acknowledgment of this short coming, because this survey involved the same monetary choice questionnaire and it was believed that a participant seeing the same survey four times would be more of a confound than testing two separate groups.

The other shortcoming of this experiment is the low number of enrolled Conservative participants (N=9). Historically, the political identity breakdown of U.S. voters is Republican: 30%, Democrat: 30%, Independent: 40% (*Gallop Historical Trends,* Accessed June 2019). Since I did not specifically recruit any political parties, there is a very low number of Conservatives. This may be a natural phenomenon due to Amherst, MA's historical political leanings as dominantly liberal, or participant's choice to not label themselves as conservative due to their conscious knowledge that they are in the political minority. Additionally, there has been an efflux of Conservatives leaving the Republican Party over the last two years (*The Washington Post,* 1/8/2018). If participants are reading Conservative as synonymous with the Republican Party, they may be

choosing not to identify as Conservative if they have recently left the Republican Party. The sample is also limited to participants who reside in Massachusetts (either as students or residents), which is a traditionally very liberal and progressive state.

In the 2020 election follow-up and my replication of this experiment in Fall 2019, I plan to reach out to conservative and Republican groups on campus such as the Young Republicans Club and majors that are historically conservative such as Finance, Economics, Political Science, and Legal Studies to recruit a larger conservative cohort.

CHAPTER 4

GENERAL DISCUSSION AND CONCLUDING REMARDS

4.1 Summary of the Two Experimental Outcomes

Together, these two experiments show that (1) delay discounting can be influenced by framing and the influence of framing differs across countries with very different decision environments, and (2) within a country after a major sociopolitical event. Collectively, these results collectively demonstrate different decision environments correspond to changes in delay discounting rates. These differences can be induced by framing choices to be in different temporal domains or by having a participant project themselves into the future and imagine the world in 10 years. In the remainder of this section, I will briefly recap the results of each experiment. In the next section I discuss the neuro-biological mechanisms of delay discounting as well as potential future directions for neurobiological experiments that examine the role of future projection and temporal framing on delay discounting.

The first experiment demonstrated that temporal framing of gains and losses has a stronger effect on Chinese participants than American participants. Specifically, Chinese participants had higher delay discounting within the Present Gain (choosing smaller rewards in the present more than larger rewards in the future) and Future Loss conditions (choosing to pay smaller fines in the present more than larger fines in the future). In the Gain domain, the Chinese groups had

with greater difference between their Present Gain and Future Gain discounting rates than the American Present Gain and Future Gain conditions, showing that Chinese participants were more sensitive to temporal framing than American participants. In the Loss domain, the difference between present and future framing was smaller in both the Chinese and American participants. The Chinese participants maintained a larger delay discounting difference between Present Loss and Future Loss conditions, than the American participants.

The second experiment showed that delay discounting changes from baseline before and after a major socio-political event, and that delay discounting becomes more implusive in groups with more pessimistic future projections. The directionality of the difference from baseline differed across income groups and political identity. Specifically, the change in delay discounting rate before and after the 2018 Midterm Election revealed within-subject differences in delay discounting rates for participants with “A Mix of Liberal and Conservative” political identity and the Upper-Class income group. Overall, these behavioral findings suggest that the direction of delay discounting difference changes before and after a major election and specifically within certain political identities and income groups. The overall pattern of pessimistic future projections resulting in participants choosing a higher proportion of short-term choices is in line with literature on decision-making under resource scarcity. These results collectively demonstrate that differences in decision environments can cause different

projections towards the future as well as the future-related choices reflected in delay discounting.

4. 2 Neurobiology of Delay Discounting

This thesis thus far, has provided a significant amount of information about the cognitive psychology of delay discounting. Most of the evidence presented has been economic theories, behavioral tasks, or neuro-imaging studies. In this section, I will provide a deeper explanation of the neurobiology of delay discounting. Then I will propose future experiments that combine the behavioral paradigms I piloted in this thesis with neurobiological measurements to directly test how future uncertainty affects the delay discounting neural mechanism.

Dopamine neurons are the primary actors in neuronal reward research. Midbrain dopamine neurons have been found to respond to motivation, act as a positive reinforcer after behavioral decisions, and encode reward expectation errors to show the clear link between reward in learning and decision making (Satosh et. al, 2003). These dopamine neurons can also change their activity based on their receptor topography. A specific class of dopamine receptor have been linked to impulsive decision making in delay discounting tasks.

The ventral tegmental area (VTA) D2 receptors have been shown to increase delay discounting impulsivity after a viral knockdown was administered in rats. After receiving the viral knockdown, the rats' delay discounting curves shifted to the left showing that they started to prefer smaller, immediate rewards

over larger, future rewards. This demonstrated evidence that a decrease in VTA D2 receptors enhances reward impulsivity (Bernosky- Smith et. al, 2017). The same class of D2 neurons in the nucleus accumbens shell have also been associated with implusive choice behavior (Barlow et. al, 2018).

Dynamic and dissociable fluctuations of dopamine in the prefrontal cortex (PFC) and nucleus accumbens (NAc) has been associated with the PFC signals changes in reward availability while the NAc encodes integrated signals about reward rates, uncertainty, and choice (Onge et. al, 2012). In participants planning to undergo deep brain stimulation surgery, microelectrode recordings were performed to target NAc neurons during a financial decision-making task. The recordings found that NAc activity predicted future financial decisions on a trial by trial basis (Patel et. al, 2013).

On a higher circuit level, it is important to investigate the brain areas involved in economic and reward-based decision making (for a review of all brain structures and their correlated responses, see Doya, 2008). In terms of risk processing, the anterior insular cortex (AIC) and orbital frontal cortex (OFC) are shown to convey signals about reward uncertainty. The OFC is thought to be encoding certain reward biased, risk modulated value, while the AIC may convey prolonged negative outcome and disappointment signals (Jo & Jung, 2016).

Using transcranial magnetic stimulation, a participant's medial prefrontal cortex (mPFC) was activated during a delay discounting task. The participant's performance was then compared to the participant's delay discounting task

performance to a control trial. The comparison showed that high frequency transcranial magnetic stimulation of the mPFC showed a decrease in a participant's delay discounting rate, but this decrease was not associated with a transcranial magnetic stimulated release of dopamine in the NAc (Cho et. al, 2015). This finding suggests that the mPFC provides an inhibitory control over delay discounting that allows a participant to choose more options in the future. A similar effect was not observed when excess dopamine, assumed to make the participant more reward-sensitive, was released. The specific neural mechanisms were mapped using fMRI (McClure et. al, 2004; Ballard & Knutson, 2009).

First, McClure et. al, located the brain regions that respond as the "beta system" and "delta system". The beta/delta system refers to a two-component model of delay discounting calculations where the beta system weighs the immediate reward, and the delta system weights the future reward (Laibson 1997). While in the fMRI participants chose between a present reward or a reward in the future. Analysis grouped all decisions where the participant chose the present reward as the beta circuit, and all decisions where the participant chose the future reward as the delta circuit. The analysis of beta choices revealed activation in the ventral striatum, medial orbitofrontal cortex, medial prefrontal cortex and posterior cingulate cortex. The analysis of the delta choices revealed activation in sensory and motor processing areas, as well as dorsal lateral pre-frontal cortex, ventral lateral pre-frontal cortex, and the lateral

orbitofrontal cortex. The relative activation of the two neural groups predict intertemporal choice within participants, such that participants with higher beta activation prefer the present reward and participants with higher delta activation prefer the delayed reward.

A follow-up study with the goal of disentangling activations due to reward magnitude and delay length prior to the participants' choice was completed by Ballard and Knutson in 2009. While in an fMRI, participants completed a monetary choice questionnaire with information presented in a staggered fashion. This staggering allowed activation due to delay and reward magnitude could be analyzed separately. The analysis revealed that the participants showed different activation patterns in reward magnitude and reward delay, as well as different activations based on impulsivity traits. This study replicated that the medial prefrontal cortex, nucleus accumbens, and posterior parietal cingulate cortex showed increased activation to reward magnitude. While the dorsolateral prefrontal cortex and the posterior parietal cortex showed decreased activation to delay length. Within subject, it was shown that participants with higher impulsivity showed reduced nucleus accumbens activation towards future rewards and reduced deactivations of the medial prefrontal cortex, dorsolateral prefrontal cortex and the posterior parietal cortex. Overall, this study shows neural evidence of separate processing of reward magnitude and delay length, as well as how individual differences can influence activations and these regions which result in changes of delay discounting choices.

Building on previous imaging studies of the neural mechanism of the discounting of future gains, Xu et. al, 2008 integrated the neural mechanism of the discounting of future gains and losses. Using a gain and loss discounting task, the researchers' analysis revealed that the lateral PFC and posterior parietal areas were active in both gain and loss discounting trials, with activations higher during loss trials. They also found evidence for negative emotion contributing to loss sensitivity due to increased activation of the insula, thalamus, and dorsal stratum during loss trials. Together, this replicates evidence that the fronto-parietal network is involved in discounting of gains and losses and adding the documented existence of an asymmetry of gains and losses occurring in the neural activation patterns.

Overall, these imaging studies provide ample evidence of a neural mechanism of delay discounting. This mechanism has been shown to respond to gains and losses differently, with evidence of the asymmetry of gains and losses existing on a neuronal level. Since our findings are related to differences in decision environment, the next steps would be to test the activations of this neural circuit under a resource scarcity manipulation or an uncertain environment gambling task. These tasks could be used to replicate differences found across economic environments or after a large-scale socio-economic event within the scanner. These paradigms would test if our current behavioral findings result in observable neurobiological differences in the neural mechanism.

4.3 Concluding Remarks and Future Directions

Collectively, these two experiments provide evidence that decision environment and perception of the future significantly impacts intertemporal choice. The first experiment replicated differences in delay discounting between the U.S. and China in the present gain condition as well as provided evidence that Chinese participants become less impulsive in both gains and losses when their intertemporal choices are framed in the future. These differences in delay discounting across temporal frame and country remaining significant after controlling for the cultural and personality differences between the groups. This experiment shows the vital role of environment in intertemporal decision-making, and how different decision environments have different responses to temporal framing and anchoring.

The second experiment showed how perception of future perspective and delay discounting can change before and after a major socio-political, and how these changes are specifically observed within specific identities. Understanding how changes due to socio-political landscape effect future perspective and intertemporal choice is vital to understanding humans navigate complex economic and social environments fraught with random (e.g., economic crises) and non-random (e.g., political administration changes) large-scale events. As well as how these events affect feelings of uncertainty that may create social responses like nationalism and in-group bias.

Overall, these to experiments add to the literature on how decision-environment and resource scarcity influence intertemporal decision making. Future research will investigate how activations in the beta-delta circuitry change with uncertainty information or information about the contents of the future decision environment. Further investigations of these behavioral patterns and the underlying neural circuitry will enable us to better understand how humans act within and respond to changes in their environments, as well as how the effects resource scarcity and future perception of uncertainty can be mitigated to lessen myopic decision-making.

APPENDIX A

CHOICE TITRATION ITEMS

Version 1 (Gift Card, Present Framing)

1. Would you prefer $50 today or $40 in three months?
2. Would you prefer $50 today or $45 in three months?
3. Would you prefer $50 today or $50 in three months?
4. Would you prefer $50 today or $55 in three months?
5. Would you prefer $50 today or $60 in three months?
6. Would you prefer $50 today or $65 in three months?
7. Would you prefer $50 today or $70 in three months?
8. Would you prefer $50 today or $75 in three months?
9. Would you prefer $50 today or $80 in three months?
10. Would you prefer $50 today or $85 in three months?
11. Would you prefer $50 today or $90 in three months?

Version 2 (Gift Card, Future Framing)

1. Would you prefer $75 three months from today, or $35 today?
2. Would you prefer $75 three months from today, or $40 today?
3. Would you prefer $75 three months from today, or $45 today?
4. Would you prefer $75 three months from today, or $50 today?
5. Would you prefer $75 three months from today, or $55 today?
6. Would you prefer $75 three months from today, or $60 today?

7. Would you prefer $75 three months from today, or $65 today?
8. Would you prefer $75 three months from today, or $70 today?
9. Would you prefer $75 three months from today, or $75 today?
10. Would you prefer $75 three months from today, or $80 today?
11. Would you prefer $75 three months from today, or $85 today?

Version 3 (Fine, Present Framing)

1. Would you prefer $50 fine today, or $90 fine 3 months from today?
2. Would you prefer $50 fine today, or $85 fine 3 months from today?
3. Would you prefer $50 fine today, or $80 fine 3 months from today?
4. Would you prefer $50 fine today, or $75 fine 3 months from today?
5. Would you prefer $50 fine today, or $70 fine 3 months from today?
6. Would you prefer $50 fine today, or $65 fine 3 months from today?
7. Would you prefer $50 fine today, or $60 fine 3 months from today?
8. Would you prefer $50 fine today, or $55 fine 3 months from today?
9. Would you prefer $50 fine today, or $50 fine 3 months from today?
10. Would you prefer $50 fine today, or $45 fine 3 months from today?
11. Would you prefer $50 fine today, or $40 fine 3 months from today?

Version 4 (Fine, Future Framing)

1. Would you prefer $75 fine 3 months from today, or $85 fine today?
2. Would you prefer $75 fine 3 months from today, or $80 fine today?

3. Would you prefer $75 fine 3 months from today, or $75 fine today?
4. Would you prefer $75 fine 3 months from today, or $70 fine today?
5. Would you prefer $75 fine 3 months from today, or $65 fine today?
6. Would you prefer $75 fine 3 months from today, or $60 fine today?
7. Would you prefer $75 fine 3 months from today, or $55 fine today?
8. Would you prefer $75 fine 3 months from today, or $50 fine today?
9. Would you prefer $75 fine 3 months from today, or $45 fine today?
10. Would you prefer $75 fine 3 months from today, or $40 fine today?
11. Would you prefer $75 fine 3 months from today, or $35 fine today?

APPENDIX B

2018 MIDTERM ELECTION SURVEY

Demographics:

1) Age:
2) Gender:
3) Zip Code:
4) Highest Personal Educational Milestone Achieved:
5) Employed?
6) What is your housing situation?
7) Have you been the victim of a crime during the past year?
8) Has someone in your immediate family been the victim of a crime during the last year?
9) In what group is your household? Please consider all wages, salaries, pensions, benefits, and other incomes that come in when specifying the appropriate number.
10) Income is measured via a scale from 1 (lowest income group) to 10 (highest income group). Please give a number between 1 and 10.
11) How interested would you say you are in politics?
    a) Very interested
    b) Somewhat interested
    c) Not very interested
    d) Not at all interested

12) Over the last five years, how do you think your interest in politics has changed?

a) Much less interested than 5 years ago

b) Less interested than 5 years ago

c) The same interest level as 5 years ago

d) More interested than 5 years ago

e) Much more interested than 5 years ago

13) How would you rate yourself politically?

a) Very Conservative

b) Conservative

c) A mix of conservative and liberal

d) Liberal

e) Very Liberal

f) My views align with a different political identity

g) I do not have a set political identity

MQC (27Q)

Answer quickly and honestly.

1) Would you prefer $ 54 today, Or $ 55 in 117 days?

2) Would you prefer $ 55 today, or $ 75 in 61 days?

3) Would you prefer $ 19 today, or $ 25 in 53 days?

4) Would you prefer $ 31 today, or $ 85 in 7 days?

5) Would you prefer $ 14 today, or $ 25 in 19 days?

6) Would you prefer $ 47 today, or $ 50 in 160 days?

7) Would you prefer $ 15 today, or $ 35 in 13 days?

8) Would you prefer $ 25 today, or $ 60 in 14 days?

9) Would you prefer $ 78 today, or $ 80 in 162 days?

10) Would you prefer $ 40 today, or $ 55 in 62 days?

11) Would you prefer $ 11 today, or $ 30 in 7 days?

12) Would you prefer $ 67 today, or $ 75 in 119 days?

13) Would you prefer $ 34 today, or $ 35 in 186 days?

14) Would you prefer $ 27 today, or $ 50 in 21 days?

15) Would you prefer $ 69 today, or $ 85 in 91 days?

16) Would you prefer $ 49 today, or $ 60 in 89 days?

17) Would you prefer $ 80 today, or $ 85 in 157 days?

18) Would you prefer $ 24 today, or $ 35 in 29 days?

19) Would you prefer $ 33 today, or $ 80 in 14 days?

20) Would you prefer $ 28 today, or $ 30 in 179 days?

21) Would you prefer $ 34 today, or $ 50 in 30 days?

22) Would you prefer $ 25 today, or $ 30 in 80 days?

23) Would you prefer $ 41 today, or $ 75 in 20 days?

24) Would you prefer $ 54 today, or $ 60 in 111 days?

25) Would you prefer $ 54 today, or $ 80 in 30 days?

26) Would you prefer $ 22 today, or $ 25 in 136 days?

27) Would you prefer $ 20 today, or $ 55 in 7 days?

BIS-11 (30Q)

DIRECTIONS: People differ in the ways they act and think in different situations. This is a test to measure some of the ways in which you act and think. Read each statement and put an X on the appropriate circle on the right side of this page. Do not spend too much time on any statement. Answer quickly and honestly.

1= Rarely/Never 2= Occasionally 3= Often 4= Almost Always/Always

1) I plan tasks carefully.
2) I do things without thinking.
3) I make-up my mind quickly.
4) I am happy-go-lucky.
5) I don't "pay attention."
6) I have "racing" thoughts.
7) I plan trips well ahead of time.
8) I am self-controlled
9) I concentrate easily.
10) I save regularly.
11) I "squirm" at plays or lectures.
12) I am a careful thinker.
13) I plan for job security.

14) I say things without thinking.

15) I like to think about complex problems.

16) I change jobs.

17) I act “on impulse.”

18) I get easily bored when solving thought problems.

19) I act on the spur of the moment.

20) I am a steady thinker.

21) I change residences.

22) I buy things on impulse.

23) I can only think about one thing at a time.

24) I change hobbies.

25) I spend or charge more than I earn.

26) I often have extraneous thoughts when thinking.

27) I am more interested in the present than the future.

28) I am restless at the theater or lectures.

29) I like puzzles.

30) I am future oriented.

Considerations of Future Consequences (12 Q)

Answer quickly and honestly.

1=extremely uncharacteristic, 2=somewhat uncharacteristic, 3=uncertain,

4=somewhat characteristic, 5=extremely characteristic

1) I consider how things might be in the future and try to influence those things with my day to day behavior.
2) Often, I engage in a particular behavior in order to achieve outcomes that may not result for many years.
3) I only act to satisfy immediate concerns, figuring the future will take care of itself.
4) My behavior is only influenced by the immediate (i.e., a matter of days or weeks) outcomes of my actions.
5) My convenience is a big factor in the decisions I make or the actions I take.
6) I am willing to sacrifice my immediate happiness or well-being in order to achieve future outcomes.
7) I think it is important to take warnings about negative outcomes seriously even if the negative outcome will not occur for many years.
8) I think it is more important to perform a behavior with important distant consequences than a behavior with less-important immediate consequences.
9) I generally ignore warnings about possible future problems because I think the problems will be resolved before they reach crisis level.
10) I think that sacrificing now is usually unnecessary since future outcomes can be dealt with at a later time.
11) I only act to satisfy immediate concerns, figuring that I will take care of future problems that may occur at a later date.

12) Since my day to day work has specific outcomes, it is more important to me than behavior that has distant outcomes.

PEW Questions (14Q)

1) How do you feel about the speed the world is changing around you compared to 5 year ago?
   a) Slower compared to 5 years ago
   b) The same speed as 5 years ago
   c) Faster compared to 5 years ago
      i) If you answered “slower” above, how much slower is it changing?
         _____ times slower (put a number between 1 to 100)
      ii) If you answered “faster” above, how much faster is it changing?
         _____ times faster (put a number between 1 to 100)
2) In which direction do you feel the world has to changed compared to 5 years ago?
   a) Very negative compared to 5 years ago
   b) Negative compared to 5 years ago
   c) About the same compared to 5 years ago
   d) Positive compared to 5 years ago
   e) Very positive compared to 5 years ago
3) I see myself as a world citizen.
   a) None of the time
   b) Some of the time

c) Most of the time

d) All of the time

4) I see myself as part of my local community.

a) None of the time

b) Some of the time

c) Most of the time

d) All of the time

5) I see myself as an autonomous individual.

a) None of the time

b) Some of the time

c) Most of the time

d) All of the time

6) How do you feel about the actions of world leaders? (Global) ____

a) I am very dissatisfied

b) I am dissatisfied

c) I am slightly dissatisfied

d) I do not have an opinion

e) I am slightly satisfied

f) I am satisfied

g) I am very satisfied

7) How safe would you feel visiting various countries around the world? (Global)

____

a) I would not feel safe at all,

b) I would feel slightly unsafe

c) I do not know

d) I would feel slightly safe

e) I would feel completely safe

8) How do you feel about the level government effort to keep you safe from harm? (Local)

a) I am very dissatisfied

b) I am dissatisfied

c) I am slightly dissatisfied

d) I do not have an opinion

e) I am slightly satisfied

f) I am satisfied

g) I am very satisfied

9) Generally speaking, tell us for each group the degree in which you trust that group: completely, somewhat, not very much or not at all.

a) Your family

b) Your neighborhood

c) People you know personally

d) People you meet for the first time

e) People of another religion

f) People of another nationality

10) How concerned are you about the following issues?

a) The economy in general
   i) Very concerned
   ii) Fairly concerned
   iii) Somewhat concerned
   iv) Fairly not concerned
   v) Not concerned

b) Your own economic situation
   i) Very concerned
   ii) Fairly concerned
   iii) Somewhat concerned
   iv) Fairly not concerned
   v) Not concerned

c) Your retirement pension
   i) Very concerned
   ii) Fairly concerned
   iii) Somewhat concerned
   iv) Fairly not concerned
   v) Not concerned

d) Your health
   i) Very concerned
   ii) Fairly concerned
   iii) Somewhat concerned
   iv) Fairly not concerned
   v) Not concerned

e) Environmental protection
   i) Very concerned
   ii) Fairly concerned
   iii) Somewhat concerned
   iv) Fairly not concerned
   v) Not concerned

f) The impacts of climate change
   i) Very concerned
   ii) Fairly concerned
   iii) Somewhat concerned
   iv) Fairly not concerned
   v) Not concerned

g) Maintaining peace
   i) Very concerned
   ii) Fairly concerned
   iii) Somewhat concerned
   iv) Fairly not concerned
   v) Not concerned

h) Crime in the United States
   i) Very concerned
   ii) Fairly concerned
   iii) Somewhat concerned
   iv) Fairly not concerned
   v) Not concerned

i) Social unification in society
   i) Very concerned
   ii) Fairly concerned
   iii) Somewhat concerned
   iv) Fairly not concerned
   v) Not concerned

j) Immigration to the United States
   i) Very concerned
   ii) Fairly concerned
   iii) Somewhat concerned
   iv) Fairly not concerned
   v) Not concerned

k) Hostility towards foreigners or minorities in the United States
   i) Very concerned
   ii) Fairly concerned
   iii) Somewhat concerned
   iv) Fairly not concerned
   v) Not concerned

l) Your job security.
   i) Very concerned
   ii) Fairly concerned
   iii) Somewhat concerned
   iv) Fairly not concerned
   v) Not concerned

11) If you were to look for a relatively well-paying job or enter the job market in the near future, how do you feel about entering the current economy? (Local)

a) I am very pessimistic

b) I am slightly pessimistic

c) I have a neutral view

d) I am slightly optimistic

e) I am very optimistic

Open Response Questions:

We're using these essays to generate ideas about how people think and perceive the future. Please write between 3 and 6 sentences about the following questions. Your essay will be used for creating future studies and having an essay of good quality will enter you to win an $100 Amazon gift card.

1) How is your day and week going so far? What are some events that have happened in your life?
2) Imagine you were able to experience the world as it will be 10 years from now. How would you describe the world you see in your own words? How do you see yourself within your society taking into account the changes in

environmental, economic, or political and technological climate? What changes do you expect in the future given what you know about the world now? How positive or negative do you expect these changes to the world to be?

(Repeat) MQC (27Q)

Answer quickly and honestly.

1) Would you prefer $ 54 today, Or $ 55 in 117 days?
2) Would you prefer $ 55 today, or $ 75 in 61 days?
3) Would you prefer $ 19 today, or $ 25 in 53 days?
4) Would you prefer $ 31 today, or $ 85 in 7 days?
5) Would you prefer $ 14 today, or $ 25 in 19 days?
6) Would you prefer $ 47 today, or $ 50 in 160 days?
7) Would you prefer $ 15 today, or $ 35 in 13 days?
8) Would you prefer $ 25 today, or $ 60 in 14 days?
9) Would you prefer $ 78 today, or $ 80 in 162 days?
10) Would you prefer $ 40 today, or $ 55 in 62 days?
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13) Would you prefer $ 34 today, or $ 35 in 186 days?
14) Would you prefer $ 27 today, or $ 50 in 21 days?
15) Would you prefer $ 69 today, or $ 85 in 91 days?

16) Would you prefer $ 49 today, or $ 60 in 89 days?

17) Would you prefer $ 80 today, or $ 85 in 157 days?

18) Would you prefer $ 24 today, or $ 35 in 29 days?

19) Would you prefer $ 33 today, or $ 80 in 14 days?

20) Would you prefer $ 28 today, or $ 30 in 179 days?

21) Would you prefer $ 34 today, or $ 50 in 30 days?

22) Would you prefer $ 25 today, or $ 30 in 80 days?

23) Would you prefer $ 41 today, or $ 75 in 20 days?

24) Would you prefer $ 54 today, or $ 60 in 111 days?

25) Would you prefer $ 54 today, or $ 80 in 30 days?

26) Would you prefer $ 22 today, or $ 25 in 136 days?

27) Would you prefer $ 20 today, or $ 55 in 7 days?

Allocation Task: Imagine that you had just unexpectedly received $1,000 and were asked to allocate it among four options. Which option would you choose?

a) Use it to buy something nice for someone special

b) Invest it in a retirement fund

c) Plan a fun and extravagant occasion

d) Put it into a checking account

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